FOUNDRY TRADE JOURNAL

Established 1902

Vol. 93 Thursday, October 23, 1952 No. 1886

PRINCIPAL CONTENTS

	Page
Features	
Leader: Technical Sales	469
Film Review	470
Luncheon	470
Correspondence	470
Notes from the Branches	478
Dinner	494
Forthcoming Events (Advert. section)	29
Technical	
Internal Stress in Castings—Report of T.S.32	471
Brassfoundry Methods, by L. W. Gummer	479
Band Friction Cutting Applied to Foundry Practice, by H. J. Chamberland	483
News	
Successful Open Day	470
"Shell" Foundry Moulds	477
British Standards Institution	482
Two More Foundries' Amenities	485
Review of B.S. 1400	486
The Iron and Steel Institute	486
Foundry Trades' Equipment and Supplies Association, Limited	487
Personal and Obituary	489
News in Brief	490
Raw Material Markets	494
Statistics	
U.K. Trade in September	488
European Coal and Steel Community Finances	488
Pig-iron and Steel Production	492
Current Prices of Iron, Steel, and Non-ferrous Metals (Advert. section)	28

PUBLISHED WEEKLY: Single Copy, 9d. By Post 11d. Annual Subscription, Home 40s., Abroad 45s. (Prepaid).

49 Wellington Street, London, W.C.2. 'Phone: Temple Bar 3951 (Private Branch Exchange) Grams: "Zacatecas, Rand, London"

Technical Sales

As a factor in technical sales, design has been of paramount importance since Tubal Cain first inaugurated the foundry industry, and at last week's meeting of the Joint Iron Council this was taken for granted. What was stressed, however, especially by Dr. Pearce, was the current and insistent need for redesigning castings in view of the two major developments which have recently been introduced. The advent of nodular iron, which is so much stronger than the conventional grey iron, demands the redesigning of castings, wherever the new material is to be applied. Unless this is done, the major advances made possible through the development of nodular irons will be largely wasted.

The second innovation stressed by Dr. Pearce was the shell moulding process. To underline the reported importance of this development we quote a statement by Dr. Pearce: "To indicate its importance in other fields, it was reported that shell moulding was now absorbing between two and three million pounds of resin per annum in the United States, and the suppliers of synthetic said that if five per cent. of all castings were shell moulded by 1957, which seemed a very conservative estimate, some 80,000,000 lb. of resin would be required annually, which was two-thirds the total current demand for all moulded plastic material, and one American metallurgist had prophesied that one-half of all sand castings would be shell moulded within the next ten years." Obviously, as shell-moulded castings are "near-precision," designers will have to reorient their views as to machining allowances and the like.

It would appear from the above that the main sales effort in the near future has to be directed towards the designer and so differs fundamentally from the normal sales campaigns, which are addressed to the general public. Yet this last phase must not be ignored. Many foundries are situated at the side of the main railway lines, and where they possess reasonable buildings and external tidyness, they should announce their names and productions in coloured lights—a matter which we note has been neglected since the war-time blackout. No opportunity must be lost in publicizing the name of one's business, in order that when inquiries are sent out, inclusion on the buyers' lists will be ensured. If but a local business is operated, then it is well to be sure that one's name is well known and respected in the area served. To be effective, technical salesmanship must reject all poor patterns; it must honour delivery promises; it must ensure, from the receipt of an order, intelligent and enthusiastic co-operation with the buyer and his technical colleagues; it must discourage over-indenting; whilst encouraging the placing of quantities so that economies in manufacture can be obtained.

Successful Open Day

On October 11 a very successful "Open House" was held at the Luton works of Hayward-Tyler & Company, Limited, and features of the day were demonstrations of moulding, coring, and pouring of non-ferrous castings in the brass foundry and the coring-up, closing, and casting of a large pump-body weighing 4¼ tons in the iron foundry, in the presence of about 500 visitors.

This particular casting is the pump end of a large size reciprocating steam cargo pump which was designed as the result of about five years' research into hydraulic losses. The casting was designed not only to reduce losses to a minimum but also so that it could be machined at one setting on a large horizontal boring machine up to the final drilling operation. It contains twenty-four cores of up to 350 lb. weight and is cast in a refined, high-grade iron of 16 tons average U.T.S. The moulds are made in floor sand, with milled fencing sand, and the cores are all of synthetic core sand, the smaller cores being cured in an Acme continuous core stove and the large ones in a Modern Furnaces batch-type core oven.

Film Review

"Packaged Power."—The story of aluminium is the subject of a colour film sponsored by the Aluminium, Limited, group of companies. For 32 minutes audiences are shown something of the processes by which aluminium is extracted and fabricated. "Packaged Power," which includes an interesting spoken commentary, owes its title to the great amount of electricity used in the making of aluminium.

The film shows how bauxite, mined in British Guiana, is shipped to Arvida, Quebec, near the great Saguenay River power developments, where it is chemically treated to produce alumina, which is then reduced to give metallic aluminium. Ingots cast at Arvida are brought to the United Kingdom, where they are rolled into sheet in the large modern continuous strip mill at Rogerstone, South Wales. An account of the new project for the mining and treatment of bauxite in Jamaica and the great new scheme for taking power from the lakes and rivers of British Columbia to convert the Jamaican alumina into aluminium, provide a climax to the film.

"Packaged Power," which won the award for the best industrially-sponsored film made in Canada in 1951, is distributed by the Northern Aluminium Company, Limited, Banbury (Oxon), and is intended primarily for circulation among men's and boys' groups, colleges, and grammar schools.

Luncheon

BUCKLEY & TAYLOR, LIMITED

The Brightside Group gave a luncheon party at their Oldham branch establishment—Buckley & Taylor, Limited—on the occasion of the opening of their new works amenities centre. Mr. Ambrose Firth, J.P., presided over a company numbering about 70 and proposed the toast of the guests, to which the Mayor of Oldham (Councillor H. B. Whittaker, J.P.) replied.

MR. B. E. STOTT, late managing director of Ferrous Castings, Limited, of Warrington, died at Llandudno on October 20, at the age of 66. He had been a member of the Institute of British Foundrymen since 1934.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

THE WHITE PAPER

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—Is the ironfounding industry as a whole really aware of the dangers implicit in the proposals set out in the White Paper on the Iron and Steel Industry?

A copy of this document has only just come into my hands and I am appalled at the prospect for the industry if the provisions affecting iron foundries become law.

Judging by the apparent lack of opposition to the proposals, there must be many of the smaller ironfounders who have not yet studied the White Paper believing, as I did, that it contained only proposals for "setting free" the nationalized section of the industry.

It is clear that unless the industry wakes up to the full implications of these fantastic proposals now and faces the government with uncompromising opposition whilst there is yet time, the future is black indeed.

Yours, etc.,

A. RONALD GILES, *Director.*

Savages Limited, Engineers and Founders,
October 17, 1952. Kings Lynn, Norfolk.

Non-ferrous Foundries in France

According to an article by Jean Donders printed in the September issue of *La Metallurgie*, there are 800 non-ferrous foundries in France to-day, where 15,000 workmen (of all grades) produce a total of 30,000 tons of castings; almost £20,000,000 turnover per year. These figures do not incorporate "tied" foundries: manufacturers of special-purpose machines, motor-cars, large industrial undertakings (metallurgical, mining, and chemical), etc., as statistics for these do not exist, although they represent an important factor. He then summarizes the output into:—*Destination of products* (per cent.): machine components, 67; plumbers' brass-foundry, 27; ornamental, 1.5; die-castings, 2.5; *division into types of alloys* (per cent.): tin-bronze, 60; ordinary brass, 18; aluminium-bronze, 8; complex brass, 3; pure copper, 1.5; cupro-nickels, 0.8 (rest unclassified).

Employee's Claim Dismissed

Mr. Justice Pilcher, at Birmingham Assizes, recently dismissed a claim by W. A. Jones (42), of Wednesbury, against his former employers, F. H. Lloyd & Company, Limited, of Darlaston, for damages for injuries alleged to have been caused by the negligence of the defendants in November, 1949. Plaintiff stated that oil on the floor of the workshop caused him to slip when he was lifting a casting weighing from 30 to 40 lb. He fell and hurt his back. He had to undergo an operation, and until January, 1951, could not do any work. The Judge held that plaintiff did not slip; he thought the accident happened when the man bent down to lift the heavy castings. He ordered Jones, who is now earning about as much as before the accident, to pay £10 towards the cost of the defence.

The G.E.C. is reducing its prices of many fluorescent lighting fittings as from October 15. The prices of some of the more popular fittings are being lowered as much as 20 per cent. At the same time the Company is reducing prices of fluorescent tube auxiliary gear by 5 per cent. Reductions in the prices of some tungsten fittings are also announced.

Internal Stress in Castings*

CONSTITUTION OF SUB-COMMITTEE T.S.32

M. M. Hallett, M.Sc., F.I.M. (chairman),
H. T. Angus, Ph.D.,
A. Braybrook, A.Met.,
A. B. Everest, Ph.D., F.I.M.,
R. L. Handley, B.Sc. (Tech.),
S. Hughes (Gardom Student),
M. C. Oldham,
R. N. Parkins, Ph.D.,
C. A. Payne, B.Sc. (Corresponding member),
J. J. Pick, B.Sc.,
R. W. Ruddle, M.A., A.I.M.,
H. Sunderland,
C. R. Tottle, M.Met., A.I.M.,
G. Lambert, Sub-committee secretary.

Technical Sub-committee 32 was established by the Technical Council of the Institute early in 1949, and held its first meeting in May of that year. Its terms of reference are "To investigate the problems of internal stress in castings."

The constitution of the sub-committee is as detailed above. The members of the sub-committee were drawn from many branches of the industry, and represent both practical and academic interests. For the first 18 months of the sub-committee's existence, Dr. R. A. Dodd, of the University of Birmingham, played an important part in its activities. He resigned on taking up a new post in South Africa and was succeeded by Mr. Pick.

The work of this sub-committee to some extent developed from that carried out by T.S.18[1] on the effect of stripping temperature on distortion in iron castings. It has led to a considerable volume of new experimental work which will require a long time to complete. Nevertheless, the discussions held so far have led to the formulation of certain basic ideas which seem of sufficient importance to justify public discussion. The purpose of this report is to describe in simple language these ideas and the evidence on which they are based, and from the subsequent discussion to ascertain the foundryman's reaction to them. It must be emphasized that they depend on a relatively small amount of work so far completed on only a few types of castings. The conclusions must, therefore, be regarded as tentative, and may very well require modification in the light of further information on a wider range of castings.

Definition of Internal Stresses

The subject of internal stresses is not an easy one. The discussion on the report of T.S.18[1] showed that there was much misconception of the nature of internal stresses, and it is, therefore, necessary to define clearly the meaning of the terms involved. Internal stresses are those stresses which may remain in a casting after it has been removed from the mould. They arise during casting and subsequent cooling and do not depend on any continuously applied external source of stress. Their effects on the casting may be similar to those caused by stresses imposed from some external source, possibly arising during normal service, but the latter type of stress disappears on removal of the external source. Internal stresses are sometimes referred to as residual stresses and in general can be removed only by heat-treatment. The main point to bear in mind is that they exist in the casting or on its surface without any apparent external cause. When combined with the stresses imposed in service, they may lead to early or unexpected failure of the casting, or to distortion during machining.

Some Origins of Internal Stresses

Internal stresses in castings may be expected to result from three main causes:—(*a*) Hindrance of contraction by the mould; (*b*) temperature differences within the casting; and (*c*) transformations in the solid metal during cooling.

Effects due to the mould.—It is well known that when a casting contracts in the mould, its contraction may be hindered by the action of the sand surrounding the casting. Steel castings, for example, are prone to hot-tearing if the sand be too hard to crush under the pressure of the casting contracting on to it. Hot-tearing, as its name indicates, is a phenomenon occurring at high temperature. Further contraction of the casting will generally widen the crack so formed, but need not leave any residual internal stresses in the casting. If, however, the hindrance to contraction leads to local plastic deformation of the casting, it is possible that internal stresses will remain in the casting after its removal from the mould. Friction between the casting and the surrounding sand mould may also impose stresses on the casting during cooling and may thus give rise to residual stresses.

Effects due to temperature differences.—Differences in temperature within a casting are a less-obvious source of internal stress.. As an example may be taken a simple grid-type of casting consisting of three parallel bars, the centre one of which is heavier in cross section than the two outer bars. If these three parallel bars are joined together at each end by a rigid transverse member, there is produced a casting in which large thermal stresses (*i.e.*, those due to temperature differences) can develop. After the mould has been poured, the

* First Report of Sub-committee T.S.32 of the Technical Council, presented to the Institute of British Foundrymen's Buxton Conference.

FIG. 1.—*Variation of Tensile Properties with Temperature*

smaller outside bars and the stiff end-members joining the three bars together will solidify and cool very much more quickly than the inner bar. The two outer bars will therefore contract by a substantial amount in a short time; during this period the much hotter centre bar will have contracted only to a much smaller extent. The greater contraction of the outer bars will thus compress the centre one. As the centre bar cools in its turn, it also tries to contract, but since the rest of the casting has by this time nearly completed its contraction, this cooler portion tends to restrain the hot centre portion from contracting. The effort by the centre bar to contract and so to pull together the stiff end-pieces, is resisted by those pieces and their resistance leads to tensile stresses in the centre bar. The effect of the stress system so set up may be to crack the centre bar under tension, or to buckle the side members under the compression to which they are subjected, or the casting may be left in a state of balanced stress, the tensile stresses in the centre bar counteracting the compressive stresses in the outer bars.

The local plastic deformation of one part of a casting is an essential feature in the mechanism for formation of internal stresses. If the different cooling rates in different parts of a casting induced only elastic deformation, all parts of the casting would ultimately contract by the same amount and there would be no internal stresses. It is the local plastic deformation which leads to differences in the ultimate amount of contraction in different parts of the casting and so to the formation of internal stress.

It is important to note that the internal stresses of the type under consideration can reach an appreciable magnitude only at fairly low temperatures. Stresses imposed on the casting, while it is still hot and soft, cause plastic deformation and this removes the stresses as fast as they are formed. All metals will deform plastically or creep at high temperatures, and the temperature range at which such movement becomes appreciable, is a characteristic of each kind of metal. In Fig. 1 is shown a series of curves produced from short-time tests on a grey cast iron (3.01 per cent. total carbon, 1.9 per cent. silicon, 0.86 per cent. manganese, 0.18 per cent. phosphorus), on a 66/34 brass and on an aluminium alloy ("Y" alloy). It will be seen that, not only the yield* stress, but also the modulus of elasticity, decreases rapidly with increasing temperature. The curves indicate that, at temperatures above 650 deg. C. for grey cast iron, any stresses developed will be rapidly relieved by plastic deformation, while for brass and "Y" alloy, the temperatures for rapid creep are still lower, being about 550 and 420 deg. C., respectively. In other words, internal stresses of any appreciable magnitude can exist in castings in those three materials only at temperatures below those quoted.

Effects due to transformations.—Some metals and alloys undergo transformations in the solid state during cooling in the mould and often the transformations are accompanied by volume changes. If the volume changes occur in different parts of a casting at different times, internal stresses are likely to be produced, particularly when the transformation temperature is low, as in the case of martensite formation in iron and steel. Martensite is not often found in unalloyed iron and steel castings but is very liable to appear when these base materials are alloyed. Castings with martensite in their microstructure may show cracks arising wholly or partly from the stresses produced by the formation of the martensite.

The characteristic defects originating from the three sources of stress discussed above may be summarized as follow:—

(i) Sand effects lead to hot-tearing, distortion and plastic deformation at higher temperatures, the last of which may, in turn, cause internal stresses to form at lower temperatures.

(ii) Temperature differences cause plastic deformation at higher temperatures, leading to internal stresses at lower temperatures and so possibly to cracking or distortion in the cold.

(iii) Transformations causing volume changes are associated with internal-stress development and consequent cold cracking.

EXPERIMENTAL WORK

A considerable amount of experimental work is being carried out by the sub-committee and is still continuing. The preliminary results already achieved, and which are included in the present Report, are intended to throw light on the relative importance of the various factors described above and thus to define the problem.

Work on Double-flanged Bars

In order to study the effect of hindered contraction in determining internal stress, tests were made on straight cylindrical bars cast with a heavy flange at each end. These bars were cast horizontally and run individually at the centre of their length. Connections were made at each end to dial gauges, so that the contraction of the bar could be measured accurately. For each experiment, two bars were cast, one with the flange at each end, and the other a straight bar without flanges. There was no connection between the two bars, the measurements on each being recorded separately.

Some typical contraction curves obtained on a

* Taken as that stress at which rapid plastic deformation takes place, as opposed to slow, steady creep.

66/34 brass, are shown in Fig. 2. In each case, one curve shows the contraction of the flanged bar, and the other the contraction of the bar without flanges. The difference between the two experiments is that, in the one represented by the curves on the right-hand portion of the illustration, the sand was rammed harder than in that represented by the left-hand illustration. When the bars had reached room temperature, as indicated by thermocouples placed in the mould, the sand was very carefully removed from the bars by first scraping away the cope half of the box and then removing the remainder of the sand in the drag half.

Looking at the left-hand curve for the unflanged bar, it will be seen that it contracts smoothly and uniformly, and that no further change in length is noted on removing the sand. Fig. 2 shows that the flanged bar also contracts smoothly, but to a smaller extent than the straight bar, the difference between the two representing the amount by which the contraction has been hindered. On removing the sand, the flanged bar then contracts further and reaches the same value as that of the corresponding plain bar.

In the curve on the right-hand side, exactly the same set of phenomena can be seen. The only difference between the two sets of curves is that the harder sand has hindered the contraction of the flange more than in the case of the soft sand. On removal of the sand, however, the flanged bar again assumes exactly the same length as the plain bar. Each of the bars, after final removal from the mould and from the apparatus, was further investigated for internal stresses by applying strain-gauges and slitting transversely. No stresses were detected in any of the bars.

This experiment shows clearly that considerable stress develops in a flanged-bar, particularly as it cools to near room temperature. On removal of the sand, the stress is relieved and the final bar is entirely free from internal stresses. This conclusion may seem surprising to the foundrymen, but it is quite understandable if the sand mould is regarded as a spring. As the flanged-bar cools and contracts, the flanges crush the sand. The sand tends to resist this crushing in just the same way as if the flanged-bar had been heated separately and a coiled spring wound round it. The spring would have permitted the bar to contract so far, but would have prevented complete contraction because of its own springing force. On cutting the spring or removing the sand, the source of the stress applied to the bar is removed, and the stress existing within the bar correspondingly disappears. Later, more sensitive work has indicated that the cases illustrated in Fig. 2 are abnormal in one respect. In general, the curve plotted from the changes in length of the flanged bar will not coincide, after removal of the sand, with the curve representing the length changes of the plain bar but will lie a little above the latter curve on the graph, *i.e.*, the flanged bar will finish a little longer than the plain bar. This is because a certain amount of plastic deformation in the flanged bar almost invariably occurs at a relatively-high temperature and the distance between the final positions of the two curves on the graph is a direct measure of the plastic deformation. This does not alter the finding that the internal stresses in the casting which are elastically balanced against stresses in the sand mould must disappear when the casting is removed from the sand.

Experiments on Triangular Grid Castings

Several tests were carried out by T.S.18[1] on a triangular grid casting which was found to give consistent results. A drawing of this casting is reproduced in Fig. 3. It consists essentially of a light outer frame designed to solidify rapidly and a heavier central member, the contraction of which is hindered by the relatively cold outer frame, so that tensile stresses are induced in the centre member.

As a first step, the procedure followed by T.S.18 in cast iron was reproduced by the present subcommittee in an aluminium alloy and in steel. Castings were made in the aluminium alloy, RR.59, at the same pouring temperature and were stripped after one minute and after 30 min. The results are shown in section A of Table I. It will be seen that in each case, the internal tensile stress in the centre member of the casting stripped after 30 min. in the mould (*i.e.*, when the casting was cold) was higher than the stress in the casting stripped after one minute.

Similarly, in the case of steel, a comparison result is given in the last section of Table I, where it is shown that a casting made in a medium-rammed mould and stripped at 1,000 deg. C. showed

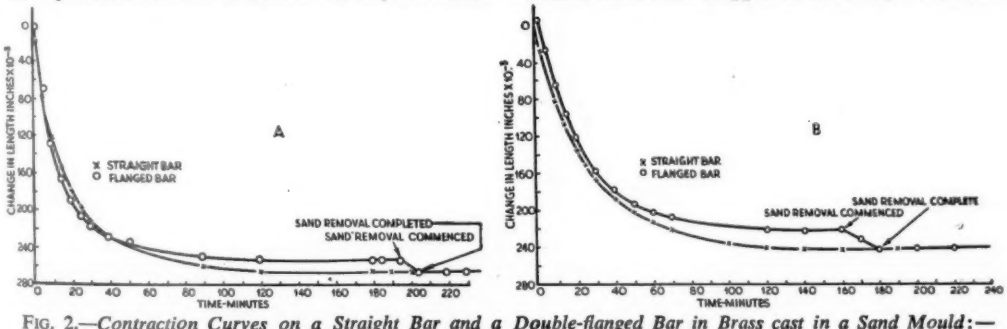


FIG. 2.—*Contraction Curves on a Straight Bar and a Double-flanged Bar in Brass cast in a Sand Mould:—(A) Medium Rammed and (B) Hard Rammed.*

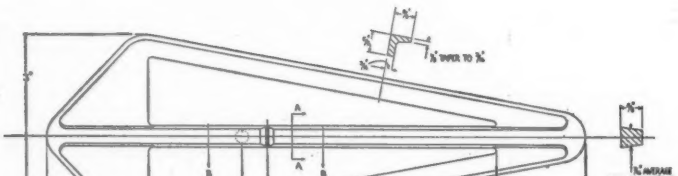


FIG. 3.—*Triangular Grid Test Casting made in Aluminium Alloys and in Steel (see Table I).*

an internal stress of 3.75 tons per sq. in., whereas, the same casting prepared under the same conditions and cooled in the mould for 24 hrs., showed a stress of 10.3 tons per sq. in.

These results, therefore, confirm that the findings of T.S.18 regarding the effect of stripping temperature on internal stresses in this particular grid-casting made in grey cast iron, apply equally to similar castings prepared in an aluminium alloy or in steel.

Using the same aluminium alloy, two series of experiments were performed on the effect of moisture content in the sand. The results are shown in section A of Table I, and are plotted in Fig. 4 (*a*) and (*b*). In each series of experiments, the internal stress in the castings completely cooled in the mould increases steadily with the moisture content of the sand.

Using the same casting and the same aluminium alloy, two other variables were studied, *viz.*: pouring temperature and the diameter of the runner, the individual results being shown in section B of Table I. The influence of pouring temperature is plotted in Fig. 4 (*c*) and of runner diameter in Fig. 4 (*d*). Internal stress increased both with increasing pouring temperature and with runner diameter.

The tests so far described on the grid casting have all been on factors influencing mainly the temperature distribution in the casting. At the same time, some work was carried out on factors which would influence primarily the strength of the sand, but not the temperature distribution. In Table I, section C, the first series of results shows the internal stresses in grid castings poured in sand moulds dried from various moisture contents. The sand dried from 3½ per cent. of water had a compressive strength of 120 lb. per sq. in., the sand dried from 5 per cent. water had a compressive strength of 175 lb. per sq. in.; and that dried from 7½ per cent. water had a compressive strength of 280 lb. per sq. in. In spite of these considerable variations in sand strength, the internal stress in the castings did not differ very much, and showed no signs of increasing with increasing strength of sand.

Similarly, two castings made in green-sand moulds, one soft-rammed and the other medium-rammed, showed almost exactly the same internal stress, as detailed in the second series of results in section C, Table I. A similar series made in steel, in green-sand moulds rammed soft, medium and hard (see last section of Table I) showed no consistent variation of internal stress with hardness of mould.

It has already been emphasized that these results are based on a rather small number of experiments and the sub-committee certainly does not regard all the indications of these few tests as finally proved. Indeed some experimental data now becoming available demonstrate that changes in the mould hardness can be associated with marked variations in internal stress, a fact not suggested by the results reported in Table I, Section C. The main point brought out by Table I is that considerable variations in internal stress can follow from changes which alter the temperature distribution within the casting, a fact not always recognized.

Work on Hollow Cylinders

A theoretical consideration of the possibility of internal stresses developing in hollow cylinders cast around a sand core, indicated that it was possible to develop stresses from sand resistance, even of the relatively low order of one to two tons per sq. in. only when the wall thickness of the castings was ⅛ in. or less. (This calculation was made on a cylinder with an internal diameter of 7 to 8 in.) Grey-iron castings 4 in. long and 2 in. inside diameter with wall-thicknesses of ¼ in. and ⅛ in., were

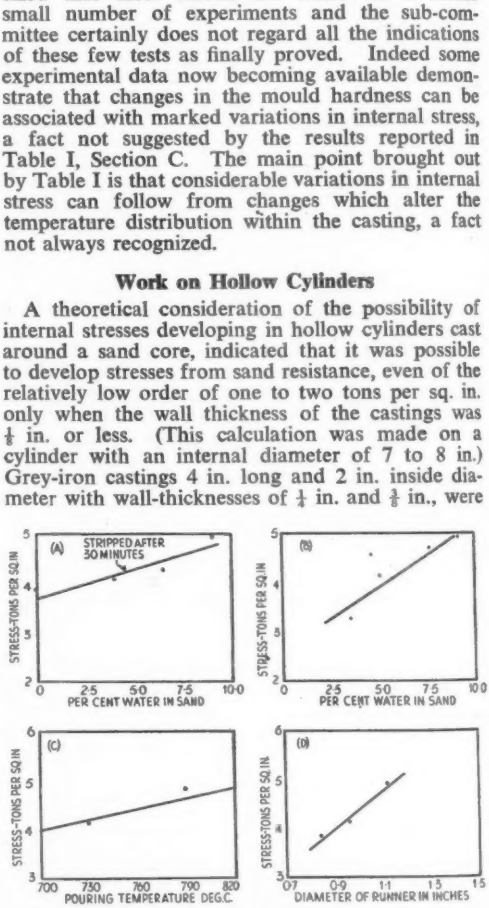


FIG. 4.—*Influence of Various Factors on Internal Stress in RR.59 Triangular Grid Casting shown in Fig. 3.*

cast with dry-sand cores having a compressive strength of 300 lb. per sq. in. No internal stresses could be detected in the resulting castings.

Further experiments were carried out on heavier-walled-castings in grey iron and in steel 4 in. outside diameter and of varying internal diameters. Considerable difficulty was experienced in obtaining reliable stress measurements, but in Fig. 5 are plotted the stresses determined on the grey-iron cylinder of 1 in. inside diameter. Here it will be seen that considerable radial tensile stresses develop, rising to a maximum at about 1 in. from the axis of the casting. Large longitudinal and tangential stresses are also present, and range from considerable compressive values near the outside of the casting to considerable tensile stresses below the bore surface. It is interesting to note that this stress distribution is similar to that determined in quenched steel cylinders,[2] *i.e.*, resulting mainly from temperature gradients. It is also known that large stresses can be developed in continuously-cast bars, which are cooled by spraying on the exterior. Without discussing the form of this stress distribution, it does appear that the stresses can be explained more readily from considerations of temperature gradients than of the sand restraint, although the evidence is not conclusive.

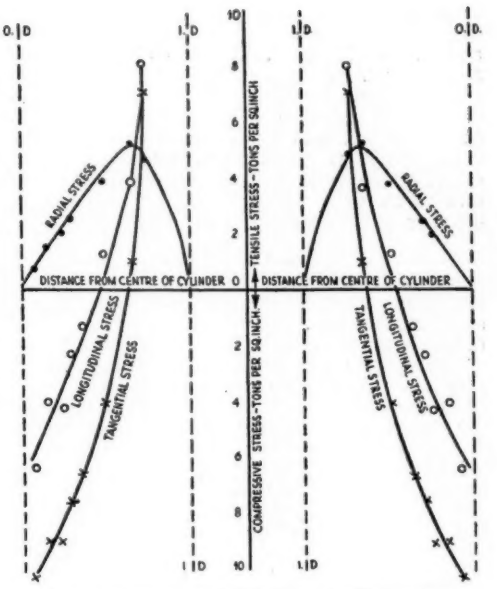


FIG. 5.—*Stress Distribution in Grey Cast-iron Cylinder* 40 *in. long by* 1 *in. dia.*

DISCUSSION OF RESULTS

The results described in this Report have been based on studies of only a few types of castings of simple design and of relatively small size. It would be unwise to put forward, as of universal application, any claims based solely on experience with these castings.

The effect of the properties of the sand on the stresses in simple castings seems to be demonstrated more clearly with regard to hot-tearing than with regard to the development of residual internal stresses; thus, on the few triangular-grid casting results reported, variations in the hardness of the sand mould had no consistent effect on the internal stresses in the casting. This is partly because the compression of the sand by the contracting casting balances the internal stresses in the casting, and on removal of the casting from the mould, the internal stresses may disappear, as shown in Fig. 2. It is, of course, possible that in some designs the hindrances to contraction will cause plastic deformation of parts of the casting at relatively high temperature, and this, in turn, will lead to the development of internal stresses as the casting cools to room temperature, by exactly the same sort of mechanism as has been described for the development of the internal stresses due to temperature gradients.

There is much more evidence to suggest that temperature gradients are a principal factor in inducing internal stress. The experiments carried out on the grid-casting showed that methods of altering the temperature distribution by changing the diameter of the runner, or altering the pouring temperature or altering the moisture of the sand, which affects the rate of cooling, all have a pronounced influence on the formation of internal stresses. It has also been confirmed that stripping this casting from the sand at a high temperature leads to a reduction in internal stress, whether the casting is in grey iron, or aluminium alloy or in steel. This reduction in internal stress is due to the effect of the hot-stripping in reducing the temperature differences between different parts of the same casting. The stress distribution in simple, hollow cylinders is similar to that characteristic of quenched billets, which is due mainly to thermal gradients.

The conclusion to be drawn from this portion of the work is that a substantial decrease in the amount of internal stress in castings may be achieved by reducing the temperature differences existing between different parts of the casting. This may be achieved by such methods as the following:—

(*a*) Removing the sand from around the heavier portions of the casting;

(*b*) using sand of high thermal-conductivity or using metallic chills around the heavy portions;

(*c*) directing a flow of air to those heavy portions by means of ducting in the mould; and

(*d*) running the casting through the thinner portions.

Any step which tends to reduce the difference in temperature between different parts of the casting will tend to reduce internal stress.

These tentative conclusions have been evolved at a comparatively early stage in the course of the sub-committee's work, and many further points remain to be investigated. Apart from further work on the effect of the mould material, studies are being made on the effect of mould temperature,

and on the effect of the size of the casting, as well as its design. Castings of a wider range of shapes are being studied. Much work is also in hand on the actual technique of stress measurement as applied to iron castings, in an endeavour to secure more consistent quantitative results. A further report will be issued later; this present Report is put forward as a short and preliminary review of the tentative conclusions reached at this stage.

Conclusions

As already indicated, the conclusions are purely tentative and are based on studies of only a small number of castings. They may well be modified by future work on larger castings of different shapes.

(*a*) Temperature differences are an important cause of internal stresses in castings.

(*b*) Internal stresses in a casting which are balanced by compression of the mould at the moment of stripping, disappear when the sand is removed from the casting. It must be remembered that where the rigidity of the mould has caused plastic deformation of the casting, permanent stresses may result.

(*c*) The stresses due to temperature-gradients in simple castings may be of a magnitude approaching the yield strength of the casting.

(*d*) Residual internal stresses can exist only at relatively low temperature, *i.e.*, at temperatures lower than that at which rapid creep under the stress concerned will occur.

Acknowledgments

Thanks are due to Prince-Smith & Stells, Limited, and to William Jessop & Sons, Limited, who kindly provided the castings used for a portion of this investigation. The whole of the experimental work on stress measurements was carried out either in the Department of Industrial Metallurgy of the University of Birmingham by Dr. R. A. Dodd and Mr. J. J. Pick, or in the Metallurgy Department of King's College, University of Durham, Newcastle-upon-Tyne, by Mr. A. Cowan. The sub-committee offers its grateful thanks to these firms and institutions for so kindly permitting the use of their facilities in carrying out the work.

APPENDIX

Measurement of Internal Stresses

The measurement of internal stresses in castings as undertaken by the sub-committee depends on the assumption that any stress produces a given strain. The relation between these two values in the case of tensile stresses is called the modulus of elasticity. If the modulus of elasticity of a material is known and a certain stress in tons per square inch is applied, the resulting movement in inches (or strain) can be calculated. Correspondingly, if a given strain is measured, then the stress which produces that strain can be determined by using the known modulus of elasticity.

If a stressed casting is cut, or any portion removed by machining, the removal of that portion will affect the stresses in other portions, and this

TABLE I.—*Effect of Some Moulding and Casting Variables on the Internal Stresses in a Triangular-grid Casting.*

Alloy studied.	Pouring temp., deg. C.	Percentage water in sand.	Mould hardness.	Runner diameter (in.).	Internal stress (tons per sq. in.) on stripping after			
					1 min.	30 mins.	1 hr.	24 hrs.
A.—*Effect of moisture content*								
A1. Alloy (RR.59) ..	730	0 skin dried	Medium	0.96	3.43 3.90	3.84	—	—
„ „ ..	730	4	„	0.96	2.74	4.09	—	—
„ „ ..	730	6.5	„	0.96	2.83 3.14	4.28	—	—
„ „ ..	730	9.0	„	0.96	4.18	4.92	—	—
RR. 59	730	3.5	Medium	0.96	—	—	3.27	—
„	730	5.0	„	0.96	—	—	4.15	—
„	730	7.5	„	0.96	—	—	4.70	—
„	730	0.0	„	0.96	—	—	4.90	—
B.—*Effect of temperature distribution*								
RR. 59	700	5.0	Medium	0.96	—	—	3.95	—
„	730	5.0	„	0.96	—	—	4.15	—
„	760	5.0	„	0.96	—	—	4.40	—
„	790	5.0	„	0.96	—	—	4.82	—
„	820	5.0	„	0.96	—	—	4.71	—
RR. 59	730	5.0	Medium	0.85	—	—	3.84	—
„	730	5.0	„	0.96	—	—	4.15	—
„	730	5.0	„	1.12	—	—	4.91	—
C.—*Effect of mould strength*								
RR. 59	730	3.5 (dried)	Medium	0.96	—	—	—	3.46
„	730	5.0 „	„	0.96	—	—	—	2.96
„	730	7.5 „	„	0.96	—	—	—	3.30
RR. 59	730	5.0	Soft (22/32) ..	0.96	—	—	4.08	—
„	740	5.0	Medium (66/72)	0.96	—	—	4.15	—
Steel (0.3 C, 1.2 Mn) ..	1,530	3.2	Soft (25/30) ..	‖	—	—	—	13.4
„ „ „ ..	1,530	3.2	Medium (50/60)	‖	—	—	—	10.3
„ „ „ ..	1,530	3.2	Hard (70/80) ..	‖	—	—	—	15 6
„ „ „ ..	1,530	3.2	Medium (50/60)	‖	3.75*	—	—	—

* Stripped at 1,000 deg. C.

change in stress will be accompanied by changes in strain, *i.e.*, by slight dimensional alterations. If these dimensional alterations are accurately measured, the stresses can be determined.

As an example, if such a casting as the triangular-grid casting illustrated in Fig. 3 is in a state of stress and the centre member is cut, the tensile stresses will be relieved and the two halves of the broken centre member will contract. The measurement of this contraction enables the original internal stress to be calculated. Similarly, if a stressed tubular casting has a succession of fine cuts machined from the bore, the removal of each layer produces a difference in stress, which can be calculated from the dimensional changes. The method of taking successive borings has been used in many previous investigations, and the mathematical considerations enabling the stresses to be calculated in three directions were finally worked out by Sachs.[3]

Gauges

A very convenient method of measuring the small strains or dimensional changes is to use resistance strain-gauges. These depend on the fact that the electrical resistance of many alloys depends on the applied stress. The gauge consists of a suitable length of fine wire, which is mounted in some medium which enables the wire to be attached rigidly to the surface of the casting under examination. The resistance of the wire is measured by an ordinary Wheatstone-bridge circuit. On cutting or machining the casting, the dimensional changes take place, and the movement of the casting correspondingly moves the strain gauge. From the resulting change in resistance can be calculated the strain, and hence the original internal stress.

Those interested in the use of strain gauges will find full details in two books by Jones[4] and Jasnell.[5] The strain-gauge technique has also been applied to the strain measurement following Sach's boring-out method.[6 7]. The whole technique of using strain-gauges needs considerable care, but in experienced hands gives results of high accuracy. One of the major uncertainties lies in the actual value of the modulus of elasticity. This applies particularly to materials such as grey cast iron, in which the modulus is indefinite. Even in such cases as these, the error introduced by this factor is not likely to be more than about 10 per cent.

REFERENCES

[1] Report of Technical Sub-committee 18. Proc. Inst. of Brit. Foundrymen, 1949, Vol. 42, p. A61.
[2] H. Bühler, Mitteilungen Forschungs Institut Vereinigte Stahlwerke A.G. Dortmund, 1931, Vol. 2, p. 149.
[3] G. Sachs, Zeitschift für Metallkunde, 1927, Vol. 19, p. 352.
[4] E. Jones, "The Measurement of Stress and Strain in Solids," Institute of Physics, London.
[5] J. Jasnell, "Resistance Strain-gauges," *Electronic Engineering*, London.
[6] O. J. Honger, H. R. Neifert and R. R. Regen, Experimental Stress Analysis, 1942, Vol. 1 (1), p. 10.
[7] R. W. Greaves, E. C. Kirtowsky and C. Lipson, Experimental Stress Analysis, 1944, Vol. 2 (2), p. 44.

"Shell" Foundry Moulds

For foundrymen the most interesting items on view at the Exhibition of Plastics being held in the Royal Turks Head Hotel, Newcastle-upon-Tyne, from October 21 to 24, is a display of the new method of making foundry moulds and cores in the form of shells from a mixture of sand and "Bakelite" synthetic resin. In this connection the following statement has been issued by the Bakelite Company.

"Though still in the early stages of development, it is calculated that this process may have very far-reaching effects on foundry technology, bringing about a revolutionary transformation in the production of castings. Based upon an invention during the war by a German foundry proprietor, Johannes Croning, and originally disclosed by an Allied Government research team, the development of 'shell' moulds has until recently been held up by an uncertain patent situation and supply considerations. These issues have now been resolved, however, and in the U.S.A. a number of important foundries are already making extensive use of the process. In this context it may be added that, whilst it can be advantageously employed with the barest minimum of equipment, the method also lends itself readily to mechanization and mass-production.

"Basically the technique depends upon the heat-hardening properties of powdered synthetic resins, a suitable grade of which has been specially developed by Bakelite, Limited. When a small proportion of these resins is mixed with sand and dropped on to a heated metal pattern, the thermosetting properties of the resins cause a thin crust to be formed, which can then be completely hardened in a few minutes by the application of additional heat. The shell thus produced forms a half-mould, and when two of these are clamped together by any suitable means, *i.e.*, by clips, bolts or even soft nails, the mould is ready for pouring. The moulds remain sufficiently rigid during pouring for very accurate casting, though their breakdown is at the same time rapid enough to eliminate the need for knock-out.

"Hollow cores are produced by suitable variations of this technique and can be made as easily and rapidly as the moulds. Speed is in fact one of the big advantages of the process and, in general, complicated designs can be produced as easily as simple ones, without the need for any special skills. Once made, moreover, the shells are light in weight and strong enough for reasonable handling so that, unlike traditional moulds, they can be stored until required for use without taking up much space. Mould-making can thus, if necessary, be separated from actual casting.

"The other big advantage of the process lies in the cleaner finish of the castings obtained thereby. The shells are not separated from the pattern until completely hardened and then accurately reproduce its smooth surface. Work to closer tolerances is hence possible and substantial savings can be made in machining costs. At the same time relatively small quantities of sand are used and there need be no waste of materials. The Exhibition, which is organized by Bakelite, Limited, will include castings made from 'shell' moulds based upon Bakelite resins, and illustrated descriptions of the various stages of the process."

NEARLY 50 FOREMEN drawn from 10 different companies in South Wales will attend residential conferences for foremen this month organized by the South Wales and Monmouthshire area training committee of the British Iron and Steel Federation.

Notes from the Branches

Scottish—Falkirk Section

At a meeting of Falkirk section of the Institute of British Foundrymen, Mr. J. L. Mitchell (Grahamston Iron Company, Limited, Falkirk); Mr. J. Ferguson (Lane & Girvan, Limited, Bonnybridge); and Mr. T. Shanks (Cruickshanks & Company, Limited, Denny), gave interesting talks on their recent tour of American and Canadian foundries. At the outset of the meeting, the retiring president, Mr. H. C. Stewart, expressed his thanks to the office-bearers and members of Falkirk section who made his term of office a most pleasant one. He commended to the section the new president, Mr. W. Bulloch (Cruickshank & Company, Limited, Denny), who held all the characteristics of a successful chairman, including a thorough grasp of all foundry subjects.

Mr. Bulloch then took the chair and in a few remarks, thanked the retiring president and members for the honour conferred on him, reviewed the activities of the Institute and asked members to continue their support. He thereafter introduced Mr. Shanks, leader of the team, who, in turn, introduced Mr. Mitchell, who presented a short report on "Production Methods for Rainwater and Soil-pipe Castings as seen in American Foundries."

Mr. Mitchell pointed out that the tour did not cover the State of Alabama, where the best rainwater and soil-pipe foundries are located. He expressed disappointment at the methods and equipment seen in the two foundries visited in the U.S.A., and finished his talk by giving details of a highly-mechanized plant seen in Canada. This plant was producing 130 soil pipes per hour, and was operated by three men only, although additional labour was needed for sand preparation, core-making, baking, and knock-out.

Mr. Ferguson spoke on "Observations on the Stove Manufacturing Industry in the U.S.A." In his short talk he explained that the steel pressings were replacing iron castings to an increasing extent. Cooking appliances were of more pleasing design, but less robustly constructed, gas cookers being most commonly employed. Fully 50 per cent. were of this type, and about 25 per cent. wood fired; only about 10 per cent. of domestic cookers utilized coal. Space heaters were usually coke or coal-fired and took the form of closed stoves on air furnaces, openable stoves or open fires being almost unknown. A high standard of efficiency was obtained in space heating throughout the whole house, in some respects superior to British practice. Mr. Ferguson explained the methods of production of these appliances, stressing the high degree of tools and plant to produce a higher output per week. Mr. Ferguson concluded with an account of a visit to a plant making electronic cookers, and outlined the possible development of this type of appliance.

Mr. Shanks addressed the meeting on "Methods Applied in Achieving Productivity in U.S.A." He dealt first with background, explaining that all Americans were production conscious. The characteristic was not wholly concerned with their productive work; it was also very evident in their social and home life. The attitude derived from this made everyone interested in whatever they were doing. Incentives of various types were almost always used and there was a general attitude of mutual support. Plant used was practically similar to our own, but it was generally noticed that there was much more of it. Dressing shops were well equipped, the most noticeable difference on this point being that more castings were either kept on conveyors or wheels, and many plants were working two or three shifts. Mr. Shanks explained that planning and control were other features very much in evidence, all operations being closely studied and recorded. The other points briefly reported on by Mr. Shanks were plaster moulding, particularly for patterns and intricate engine parts, the basic-lined cupola and synthetic resins and dielectric drying.

Scottish—North-eastern Section

About 50 members and visitors of the North-eastern section of the Scottish branch of the Institute of British Foundrymen attended the opening meeting of the 1952-53 session, which included the presidential address and was followed by a smoking concert. It was held at the Imperial Hotel, Arbroath, last month, and the president, vice-president and assistant-secretary of the Scottish branch accepted an invitation to attend. During his address, Mr. J. F. Webster, section president, spoke about the early days of the Institute and briefly traced its growth and expansion up to the present. After light refreshments, Mr. J. Mitchell, of Dundee, presented to the Institute an oil painting, "A Foundry Study," which Mr. John Bell accepted. In his remarks, Mr. Bell stressed the benefits of membership and the stimulation obtained by attending meetings and participating in the discussions. Mr. A. Marshall also addressed the meeting on various activities of the Institute, dealing especially with the educational facilities provided and the need for considering quality of membership as well as quantity. He said he hoped anyone who was able to influence young foundrymen would encourage or persuade them to learn the theory of their trade and attend the Institute's meetings. At the close of the evening, songs were rendered by Mr. Conway Stuart.

Our Pictures show (top) the Artist, Mr. J. Mitchell, presenting the Painting to Mr. John Bell, and (lower) Mr. Bell presenting Mr. Daniel Sharpe with his Honorary Membership Certificate.

Brassfoundry Methods*

By L. W. Gummer, M.I.Mech.E.†

In his contribution to the Brassfoundry Productivity Conference, the Author dealt mainly with pressings, forgings and related tools and reiterated and enlarged upon the remarks contained in Section 18 of the Brassfoundry Productivity Report. Certain aspects of this subject of common interest to the brass casting industry have been abstracted in what follows and the discussion which ensued has been treated similarly.

The tour of American brassfounding industries was by no means a one-way traffic of "know-how." It was discovered that the team could learn from and teach the Americans, and they in turn responded wonderfully in both giving and asking for information. It was found, for instance, that the British were technically ahead on the design of presses and consequently on tooling-up for hot-brass stampings, but that American output from equipment we would consider obsolete was usually higher due to the full utilization of what was available. It is certain that the information given them by the British team on hot-brass pressings was quickly followed up and is now more than likely producing results.

Safety Measures and Devices

The pace worked at whilst being observed seemed to be the pace worked permanently, and all safety measures that impeded progress were changed for others. In some cases, machines would just not be permitted to run in this country under similar conditions, but there was no evidence to prove that there was a higher accident rate in the United States. They may be explained by the constant reiteration of safety slogans, or by pre-training in avoiding accidents. Many shops can show very fine figures for accident freedom.

The device shown in Figs. 1 and 2 has previously been mentioned in other productivity-team reports, and this fact serves to emphasize the wide use made of it in American industries, despite the implication that the operator is "chained" to a machine. It constitutes the sole safety measure taken on a machine and no fitted guards are used. Nevertheless the 1945 "Report of the Committee on Safety in the use of Power Presses" of the British Ministry of Labour Factory Department condemned this type of guard as unsafe. However, the operators under these conditions certainly seemed less hampered than would have been the case with guards fixed to the press; output was correspondingly greater and accident rates similar to or lower than ours.

Another simple measure towards safety was the painting of the floor at the operator's working position with rubber paint, which was later sprinkled with sand. This provided an excellent non-slip surface for the operator and did not present a step, as would rubber mats or duck-boards.

Most firms had a display board indicating the number of days since the last "lost-time accident" and it was common to see figures as high as 500 and in some cases 800 to 900.

Handling Methods

Quite wide use was made of conventional conveyors and lifting tackle of all types, and monorails often incorporated bus-bars for supplying the current to mobile units at any point, without the inconvenience of trailing wires. Fork-lift trucks were the most common means of factory transport used, in conjunction with power-driven hand units for intermediate local movements of the "tote" boxes or pallets. An interesting pallet adaptation used at one company was very efficient. The bulk load of metal was interspaced with "pallet ingots" of the same material, enabling the fork-lift truck to unload direct from freight car and stack in the shop. Since they were expendable, problems of "returns" and nett load weights were not encountered.

The large-size "tote" boxes that were in use were transported by fork-lift trucks, the difficulty usually experienced in feeding a second operation being overcome by means of a tilting and raising device shown in Fig. 3. This enabled a common work level to be presented to the operator until the bin was empty. Movement was controlled by an electric hoist, the switch being conveniently placed near the operator's position.

Die or Pattern Storage

Fig. 4 shows a stores method that was unusual but very effective, and was used for the storing of fairly heavy dies or could serve equally well for pattern-plates. The cradle was suspended by wire ropes from electric hoists running on a monorail across the width of the storage rack. For loading or unloading, the cradle was positioned in the vertical runners by engaging the eccentrically-mounted guide wheels in line with the shelf required. The storekeeper, whilst standing in the cradle, raised it to that shelf by means of the electric hoist control, and then removed a tool from the shelf on to the cradle and lowered both as well as himself to the floor. The item was then handled by fork-lift truck. These trucks place the heaviest dies into the two outer sides of the shelving directly. The system enabled dies or patterns to be stored up to 20 ft. high, thus conserving valuable floor space.

* Confusion is often engendered by the term "Brassfoundry." In this context the word means not only brass and other copper-base castings, but also production and processing of hot-brass pressings and the like. Indeed, the Brassfoundry Productivity Team, as well as the Harrogate Conference, were themselves representative of this over-all grouping.—EDITOR.

† The Author, a director of Gummers, Limited, Rotherham, was a member of the Brassfoundry Productivity Team.

Brassfoundry Methods

Union Attitudes

Perhaps one of the most influential matters affecting production was the approach of the trades union to the subject. In this country there is to-day some recognition of production being a matter in which a union can take notice, but this is of comparatively recent birth and prior to the last few years, a union official would consider that it was "sticking his neck out" if he interested himself in matters other than "defending that which had been so hardly won"—or rates of pay or conditions of working. The American union official, on the other hand, was a keen advocate of productivity—almost an enthusiast and there was no suspicion that in this approach there was any thought of their members holding back. They know without any further persuasion that their interests as well as their members' interests lie in getting the job done as quickly and at as low a cost as possible. British employers, generally, do not enjoy that co-operation and are still surrounded by distrust. When relations here compare with the United States in this respect, we shall be on the way to getting similar results.

These factors in turn have influence on the purchase of plant of considerable cost. At least, the American boss knows no fear that his expensive plant will be working at half speed and in consequence faces up to the cost of it with alacrity.

Size Effect

The major difference between the two countries; that of size, really indicates the difference between the two techniques. The enormous volume of business available to the American means that he specializes on a few lines and his plant is designed to best deal with this work. The location and the layout are the most suitable for that job. Moreover the plant is usually worked a full 24-hr. day and, without so many varied tools and dies to concern himself with, other problems so important here do not exist for him. He gets extensive runs and can set his stall out to get the utmost facilities for handling these runs. One feature of which the team heard much was that a year's output for one customer could be perhaps completed in a few weeks. By offering special terms that customer could be persuaded to accept the whole of his year's needs in one delivery. It would have to be a very attractive offer to tempt a Britisher to do this, with thoughts of storage and stagnant money foremost in his mind. In America, the plants and press firms are specialists and are related to their customers' trades whether that trade be electrical, refrigeration or the motor industry. Each press shop would pass along business for which its tools were not strictly suited.

The higher concentration of the industry leads to more efficiency in many ways, but perhaps none more so than in plant layout. One recently constructed plant was laid out on rather novel lines. Instead of the line-production usual, there was side-to-side production, or it might be described as a hundred line-production factories rallied into one. All material was received at one side of the building and from there travelled direct to the spot in the 65-acre factory where it would be worked. By this means it was claimed that there was no stock room but rather a number of piles of stock dispersed throughout the factory. The whole purpose behind this system was obviously that no material was handled twice in the same form. Stock control under these circumstances is claimed to be easy and there is no complicated paper-work to control it, for it is actually visual and the operator can see or his manager can see quickly the state of affairs. With the introduction of this method, thirty-four persons were transferred to productive work. There was no "parts" storeroom, no finished-goods warehouse and no "goods in process" inventory. From the assembly point they went direct to despatch and overhead handling was the major means of moving goods as by this means narrower gangways could be worked. All "tote" boxes were built so that they could be slung by overhead crane or lifted on fork-lift trucks. All boxes were of the stacking type and the phrase "free air-space" was commonplace in the States—in this particular case, boxes were stacked 17 ft. high.

That completes the Author's observations on American methods applied to brassfoundry. They are essentially sketchy since only some of the techniques were applied in six works. Enough was seen, however, to convince the team that their findings must be discussed, and in this field as in most others, there is much that a new approach can do.

DISCUSSION

MR. M. BOYD (B. & D. Products (Halifax), Limited), having in mind particularly the point of view of the small firms, said that none of the team who had toured America had given an illustration *per capita* of what they had seen, compared with what had been done in this country, and he hoped Mr. Gummer would be able to elaborate further on this aspect. He knew, he continued, that the Americans could tool up for thousands or hundreds of thousands off; but we in this country had to bear in mind the customers' requirements. Americans seemed to spend more money in persuading customers to buy something than was spent here in making it! British suppliers knew within very fine limits what was required from one year's end to another; and had always an open mind as to what might be wanted next year. Commenting on Mr. Gummer's reference to lack of factory supervision in America, he said that it represented a danger to which an operator was exposed. He asked what Mr. Gummer felt about factory regulations in relation to output.

MR. GUMMER replied, with regard to factory inspection, that surely he was not being asked, as an employer, to criticize the British factory inspectorate. He was very careful to claim them as his best friends; they guided and instructed, but never hindered him. That did not mean that conditions in this country were necessarily comparable with those in the United States; he would be the last to criticize the inspectorate there.

Factory Inspection

MR. B. G. DEWSBURY (Harrisons (Birmingham), Limited, and joint secretary of the Productivity Team), dealing with the question of factory inspection, particularly with regard to the prevention of accidents, said the policy in America was entirely different from ours. In this country an effort was made, with the aid of the factory inspector, to protect the operator in such a way that an accident could not occur. This policy did to a certain extent impede production, whereas the policy in the United States was to educate the operator to appreciate that a machine was dangerous, and to leave it at that. The fact that a machine was dangerous was impressed most emphatically upon the operator; he or she had been warned and, if an accident occurred, it was just too bad.

He had made a close study of the accident rates in America, and the figures given to the team, and published in the shops, were remarkable. In some quite highly-mechanized shops there were periods of up to 800 days without a loss-of-time accident. He believed Americans could achieve substantial extra production by reason of the fact that machines were not guarded in a manner which could impede the operator. In America, insurance companies played a far greater part in accident prevention than did the factory inspectors, whereas in this country the reverse held.

MR. EDGAR N. HILEY (National Brassfoundry Association) said he believed it was true that social-security measures which were available to a workman who was incapacitated in this country either did not obtain at all in some States or did not obtain in any State to the same degree as in this country. Consequently there was very good reason for a worker in America to be extremely careful. Whether we preferred to underwrite a worker's carelessness by our social-welfare measures, or preferred the American method of making a man careful for economic reasons, was purely idle speculation, because those were the ways in which our respective countries were run. The question was fundamentally psychological, and we could never do much about that.

THE CHAIRMAN (Major R. C. Watts, M.C., vice-president of the National Brassfoundry Association) commented on the attitude of the average American manufacturer when he was asked to make a very small number of an out-of-the-ordinary product for a particular customer. The attitude was a source of trouble in Britain; makers were not asked for standardized articles, especially when it came to something claimed to be artistic, *e.g.*, a handle or other door fitting. Sometimes an architect preferred a design by reason of the fact that it was not included in any catalogue, and the fewer he could get the better was he pleased. A manufacturer would undertake to make the design exclusively for the architect and, when the three or four dozen of the product had been produced, to destroy the pattern, so that the product could not be made again so far as that manufacturer could prevent it; whereupon the architect was delighted. Were there such customers in America?

MR. GUMMER said that conversations he had had with a vice-president of the Crane Company in America had led him to believe that highly ornamental work there was often produced at a loss. However, there were still people in America who were prepared to make what a customer wanted and hoped that charges would cover the cost.

MR. HILEY drew attention to another productivity report, on simplification, which was one of the most important reports produced by the Anglo-American Productivity Council. It tried to persuade firms that they just did not know what were their true manufacturing expenses on "silly little specials."

Safety Consciousness

MR. DAVID E. BUTTERWORTH (Lancaster & Tonge, Limited) was particularly interested in Mr. Gummer's remarks because he had worked in the United States as a machine operator for about a year, and since then he had had some difficulty with factory inspectors here because his views on the safety of machines tended to hark back to that period. After his return, he had tried to instil productivity consciousness by the slogan method as used in the United States. It was difficult to assess the success of the method, but there was so much leeway to make up that he had felt it ought to be tried. His firm had specially made some posters showing ways to quicker production and safety. It led him to enquire if it would be possible for the Team or for some other authority to try to interest some such body as, say, the Council of Industrial Design to produce posters which could be used, not only in engineering brass foundries, but universally throughout the factories in the country. They would show what could be gained by increased effort and what advantages could accrue from increased safety consciousness. He appreciated that some posters existed, but they seemed to be few and far between.

MR. GUMMER mentioned that there was already in existence a very enthusiastic body very anxious to receive encouragement in putting out such pictures. So far, they felt baffled by the lack of response and nothing they could do seemed fruitful. One of the difficulties was that some workers, particularly the young, with a tradition behind them of generations of independent thinking, liked to believe that they were thinking for themselves, and just ridiculed the posters.

MR. DEWSBURY pointed out that most of the insurance companies in this country organized accident-prevention departments, and on application one would find that they were only too pleased to help with the supply of literature and posters.

MR. W. R. MARSLAND, President, A.B.B.F., had found in America that the best factory inspectors were the insurance companies. They had to take the risks, and to safeguard their interests they employed highly qualified technical men who were responsible for the safety of the plants. They did a better job than did any factory inspectors there.

Brassfoundry Methods—Discussion

American Devices

MR. E. C. MANTLE (British Non-Ferrous Metals Research Association) asked what objection there was to some of the machine safeguards used in America. He instanced the arrangement which had been described, whereby the operator's hand was forcibly removed from danger, and he recalled having seen also a safety device in which a rod swept across the front of a machine and gave the operator a blow on the wrist if he did not remove his arm.

MR. GUMMER, admitting that he had not been trained in accident prevention, felt that an answer to the question was that the British factory inspectors could appreciate that mechanical safety devices involved a great deal of maintenance. Speaking of the arrangement which involved "manacled wrists," which had been described, he said that, apart from the psychological aspect, he imagined that the slightest distortion or wear or disconnection of any of the rods might mean that the operator's hands would not be pulled far enough back to ensure safety. In other words, anything mechanical for moving the body out of danger would appear to have weaknesses. As to the rod which swept across the machine and moved the operator's hand away from danger, he said that by timing his movements the operator could dodge it when he liked; but he had to be quick enough.

Conclusions

THE CHAIRMAN, thanking Mr. Gummer for his Paper, said it covered many points, which were put forward very clearly and it might well clear up many brassfounders' difficulties. His remarks had given the opportunity to consider exhaustively the difference in outlook as between America and this country in respect of accident prevention. There were two philosophies; one purpose could be either to make a machine so foolproof as to ensure that, however it was abused, the worker would be safe, or another, in contrast, was to make a machine safe in itself and at the same time to ensure that the operator was conscious that it could be dangerous if worked improperly. In his view, the least satisfactory method was a mixture of the two, *i.e.*, to provide a machine with ineffective safeguards, without properly warning the operator; such a practice would lead to more accidents. The two countries had made their choice in the matter—the Americans had chosen to warn the operator that his machine was dangerous and that he must look out for himself, whereas in Britain we had chosen to ensure that a machine was not dangerous, and therefore one need not talk much about the matter to the worker. Brassfounders must necessarily comply with the prescribed regulations in this country. At the same time, it was of advantage to know that an alternative philosophy obtained in another country, so that comparisons could be made.

ASSOCIATED ENGINEERING HOLDINGS, LIMITED—Mr. G. Fisher has resigned his seat on the board.

British Standards Institution

The Monthly Information Sheet for September lists under New Standards Issued: B.S. 1121 Part 25: 1952, Methods for the analysis of iron and steel Part 25. Vanadium in ferro-vanadium. 2s. B.S. 1121 Part 26: 1952. Methods for the analysis of iron and steel Part 26. Molybdenum in low alloy steels. 2s.; 1826: 1952. Reference tables for thermocouples. Platinum/rhodium *v.* platinum. 7s. 6d.; 1827: 1952. Reference tables for thermocouples. Nickel/aluminium *v.* nickel/chromium. 6s.; 1870: 1952. Men's safety boots and shoes. 2s. 6d.; 1886: 1952. Terms and definitions for single-point cutting tools. 6s.; 1889: 1952. Dimensions of foundry moulding boxes. 2s. 6d. Under "Revised Standards Issued" there are B.S. 143: 1952. Malleable cast iron and cast copper alloy pipe fittings for steam, water, gas and oil. 7s. 6d.; 1256: 1952. Malleable cast iron (whiteheart process) and cast copper alloy pipe fittings for steam, water, gas and oil. 7s. 6d.

Revised Standards

Revised standards for malleable cast iron and cast copper-alloy pipe fittings (screwed B.S.P. taper-thread or A.P.I. line-pipe thread) for steam, air, water, gas and oil (B.S. 143:1952) and malleable cast iron (whiteheart process) and cast copper-alloy pipe fittings (screwed B.S.P. taper male and parallel female thread) for steam, air, water, gas and oil (B.S. 1256: 1952) have been issued with a view to simplifying the range of sizes of fittings and to provide only for those sizes in common use. These standards specify the standard dimensions of plain and reinforced malleable cast iron and cast copper-alloy pipe fittings suitable for working pressures up to 200 lb. per sq. in. in the case of water, and up to 150 lb. per sq. in. in the case of steam, air, gas and oil. They also provide for the customary types of equal and reducing fittings for use with nominal pipe sizes within a range of $\frac{1}{4}$ in. to 6 in. Tests for porosity and ductility are specified. Copies of these standards may be obtained from the British Standards Institution, sales branch, 24, Victoria Street, London, S.W.1, price 7s. 6d. each.

Reference Tables for Thermocouples

The British Standards Institution has recently published the following standards:—B.S.1826 Reference tables for platinum/rhodium *v* platinum thermocouples and B.S. 1827 Reference tables for nickel/aluminium *v* nickel/chromium thermocouples. These reference tables are for use in converting thermocouple voltages into the equivalent measured temperatures and in defining the relation between impressed e.m.f. and scale reading for pyrometers which indicate temperature directly.

The tables for platinum/rhodium *v* platinum thermocouples are based on the tables formulated by the National Physical Laboratory, which have been the basis of reference in the United Kingdom for many years. The tables for nickel/aluminium *v* nickel/chromium thermocouples are based on the tables formulated by the National Bureau of Standards of America, since no other tables are in common use in the United Kingdom. The tables specify the e.m.f./temperature relations for the thermocouples in four ways, as follows:—(*a*) millivolts to deg. C.; (*b*) deg. C to millivolts; (*c*) millivolts to deg. F. and (*d*) deg. F. to millivolts.

Copies of these standards may be obtained from the British Standards Institution, sales branch, 24, Victoria Street, London S.W.1, price 7s. 6d. and 6s. each respectively.

Band Friction Cutting Applied to Foundry Practice

*By H. J. Chamberland**

Receiving a share of recognition these days, in relation to modern and efficient foundry practice, is the friction bandsaw which materially helps in reducing costs of gate, riser and other ferrous-casting trimming cuts. A major advantage of the process is low tool cost as distributed over the amount of square or linear inches the friction band will cut before it has to be discarded. It must be borne in mind, however, that the process has certain material thickness limitations which must be adhered to, but the fact remains that within this boundary line there is no more economical method of separating metals. In consideration of long tool life and unexcelled productivity within its scope, friction bandsawing equipment is proving an excellent investment in foundries.

In so far as foundry applications are concerned, the friction cutting bandsaw has advantages to compensate in greater part for what it must necessarily lose to other methods better adapted to the thicker cuts. Although a 1 in. wide precision sawband is recommended for straight cutting, it also makes friction contour sawing possible to a radius of 9 in. or over; ¼ in. bands are also very often used to navigate with greater ease through hard-to-reach sections of the casting and, with general shop applications, ½ in. bands permit with absolute safety the friction cutting of radii as small as 2½ in. Through closer cutting, the friction band also reduces metal lost and thereby also reduces subsequent grinding costs, and, of course, within reason, the band is not subjected to any serious effects from its twisting action through work-misguiding errors.

Variable-speed Cutting

The highest efficiency when friction cutting by the bandsaw method results from taking advantage of wide range of velocities made available by the variable-speed unit of the machine. Laboratory tested velocities for materials within the friction-cutting category vary from 3,000 to 10,000 ft. per min. Since the softening action of the material directly in front of the saw teeth is in the greater part governed by the velocity being suited to material thickness involved, rather than by Rockwell hardness, the cutting should be done at the proper saw speed as far as uniformity and nature of cut will permit.

Of course, with gate and riser cutting where three or four and even more cuts varying in thickness are involved, it is sound policy to maintain a velocity corresponding to the thicker section and sacrifice what amounts to a negligible drop in over-all efficiency. This step is by far less significant as applied to the friction saw than to other cutting methods, because the friction band can remain set at 10,000 ft. per min. and be kept cutting for six or seven hours on any permissible material thickness with very slight depreciation in saw life. For the fact that when even cutting stainless steel (see Fig. 1) the life of the friction band is estimated in hours, rather than minutes, as is often the case, the importance of selecting the proper course for each application cannot be over-stressed.

* Research engineer, the DoALL Company, Des Plaines, Ill., U.S.A.

Applications

Whether it friction cuts or actually cuts, the high-speed bandsawing machine is industrially acclaimed as one of if not the most efficient means to cut or shape most types of materials industrially used. From a friction-sawing angle, most steel alloys are within the melting point range and therefore lend themselves readily to cutting by friction. Although

FIG. 1.—*Friction sawing ¼-in. Sections of Stainless-steel Castings, using ¼-in.-10 pitch Special Blade at a Velocity of 10,000 ft. per min. Cutting Rate averages 25 lineal in. per min.*

Band Friction Cutting Applied to Foundry Practice

stainless in all its forms and types responds to the friction band better than to any other method of cutting, it is yet the most resistant to the process and for this reason cutting rates on most other steel alloys and cast irons will be found to be proportionately higher.

As previously mentioned, Rockwell hardness is immaterial, since hardened steels and particularly welded sections are excellent friction sawing applications. On the other hand, the thickness of cut and the composition of the material are definitely controlling factors. Various alloys added to the iron alter the softening characteristics of the metal and obviously make it necessary to change the amount of heat at the point of material/saw contact, with additional heat being required as material thickness increases. Heat requirements must therefore be met by adjusting the saw to the proper velocity as selected from the variable-speed range.

Cutting Procedure

High saw-speeds and uniform work pressure are what create frictional heat, there is some resistance as the work first makes contact with the saw, but the cutting action starts almost immediately as the required pressure is applied. The thinner the edge presented to the saw, the faster the cutting and the operator usually works out a so-called work "rocking" technique of his own to attain this result when cutting the thicker sections. Through these means of work/wheel contact, sections up to 2 in. thick on some castings may be economically friction cut but it is well to abide by the generally applied 1 in. limitation on thickness, unless otherwise advised by the manufacturer of the equipment. Heat as generated to soften the material in the kerf to a plastic state has positively no effect on the saw teeth or any other part of the friction band, which, being 255 in. long and revolving generally at from 2½ to 3 miles per minute, there are actually millions of teeth in action, but they are in sectional contact with the metal for an infinitesimal part of a second. Any amount of heat generated is readily dissipated as the long saw-band revolves around the 36 in. dia. wheels.

Heat Dissipation Effects

Heat penetration into the side walls of the finished cut is almost negligible, it increases in depth with increased material thickness but never exceeds 0.002 in. With untreated materials which respond to air-hardening, the material immediately adjacent to the cut will be found to have an extremely thin skin hardness due to the temperature reached by friction. So long as the material responds to air-quenching, the air entrained in the rapidly moving saw cools the material rapidly enough to cause a minute skin hardness detachable only by the time-honoured file-test, since the hardening zone is so thin that even testing instruments fail to register measurements.

Behind the zone of hardness will be found a very narrow annealed area, so small that it is not objectionable. Friction sawing, therefore, does an excellent job in cases where heat-distortion due to machining presents a problem. In the case of heat-treated materials that do not react to air-quenching, only a very narrow zone of annealing, as previously stated, will be found.

Non-ferrous Cutting

It should be understood, that "friction" sawing and "high-velocity" sawing are two distinct cutting techniques, the latter being only a modern form of "actual" sawing, requiring, as with conventional procedure, a decrease in saw velocity for any increase in material thickness, and the fundamental rule of chip production that friction generates heat and heat destroys temper still prevails. In short, the high-speed bandsawing technique applies to all materials currently cut within the conventional speed range of 50 to 1,500 ft. per min. With the high-speed technique, however, the former maximum of 1,500 ft per min. is the minimum of a range extending to 5,000 ft per min. Benefiting substantially from this further innovation are the light metals and, for this reason, the friction bandsawing machine is excellent for this purpose because most cutting operations on aluminium and magnesium castings may be economically executed at velocities of from 3,000 to 4,000 ft. per min. with no limitations on thickness of cut.

A primary essential to get the most from the high-speed machine with the cutting of the light metals is the special coarse-pitch buttressed band. This new type of tooth design affords a tool having maximum free- and cool-cutting qualities, since it provides narrow saws of coarse pitch construction without sacrificing band strength. From the viewpoint of increased production, high-speed sawing has relatively the same effect on light metals as friction sawing has on ferrous metals.

Notwithstanding the cool-cutting action of the buttressed saw, the importance of some form of lubrication when cutting light-metal sheets, billets or castings, is highly significant to prolong tool life. Very suitable is some dependable form of drip lubrication with 40 to 50 drops per minute, but preference should be given to the spray system, which is more efficient and more economical in the long run. A high-grade sulphurized soluble oil to 10 parts of water makes an excellent spray mixture, this form of lubrication shows a general increase in saw life on the light metals of at least 25 per cent. and very often as much as 50 per cent.

Unit Dust Collection. Dallow Lambert and Company, Limited, Spalding Sheet, Leicester, have issued a leaflet to describe a line of unit dust collectors. A very wide range is being manufactured yielding something of the order of 135 different combinations. The cabinet houses at its base a quick-release bin, withdrawable face and side. Above it is the dust inlet on any one of its four sides, and surmounting it is the filter, the fabric of which is fire proof and shaken semi-automatically. Finally the uppermost section carries the motor and fan, with the cleaned air escaping in an upwards direction. The pamphlet and other details can be obtained by writing to Leicester.

Two More Foundries' Amenities

Buckley & Taylor, Limited

Last week, the Mayor of Oldham opened an ablution block at the works of Buckley & Taylor, Limited. This building is equipped with locker accommodation, washing and bathing facilities for 108 employees. Each man is provided with two lockers, one to accommodate his clean clothes and the other his working clothes. The lockers are arranged in two tiers, individual lockers being 3 ft. high by 12 in. wide and 12 in. deep. They are fitted with clothes hooks and soap tray. Each locker is individually ventilated and heated by steam coil.

The bathing accommodation comprises 8 shower cubicles, 15 wash basins and 3 footbaths, each being supplied with hot and cold water services and the showers are each provided with water-mixing valve to enable the user to bathe in water of a suitable temperature. The hot-water service is supplied by a 200-gall. copper calorifier which supplies water at a temperature of 1,500 deg. F. to the numerous points of draw. Cold water is supplied from a 300-gall. cold-water storage tank and supply mains are run to serve the shower fittings, footbaths and basins.

During the winter, hot water is provided from the main steam boiler which also heats the whole of the works and when this closes down during the summer an auxiliary steam boiler is brought into use. The locker rooms are heated by warm air supplied from an adjacent steam battery and ducted through grills above the vestibule doors. The shower room is warmed by steam heated Vectair radiators in both rooms. The temperature is maintained at about 70 deg. F. The building and each individual locker are disinfected daily. The equipment in the ablution block was designed and installed by the Heating and Air Treatment Division of the Brightside Foundry & Engineering Company, Limited, which operates from branches situated in 12 of the principal industrial and commercial centres throughout the country.

Buckley & Taylor, Limited, was founded in 1861 and in 1947 the business was acquired by the Brightside Foundry & Engineering Company, of Sheffield, when the manufacturing facilities were altered and improved to cater for the manufacture of rolling mills and auxiliary equipment for both steelworks and the non-ferrous metal industries. Buckley & Taylor, Limited, employs some 300 personnel out of a Group total of 2,500. The past five years have seen many improvements, both in equipment and layout, in addition to a general improvement in working conditions. A new drawing office block was opened in 1948 to accommodate an increased design staff, and about the same time many old buildings dating back to the foundation of the Company were pulled down and replaced by a new erection shop under a single-span roof. An extension to the original iron foundry has recently been completed, with a view to giving an increased tonnage, output of castings ranging from a few hundredweights to 20 tons.

Thomas De La Rue & Company, Limited

At the Portobello Works of Thomas De La Rue & Company, Limited (Gas Group), at Warwick there is also an interesting example of a modern well-equipped foundry washroom. Designed to provide hanging and washing accommodation for 356 male operatives, it is fitted with a 3 ft. 6 in. dia. wash fountain, three 6 ft. long washing troughs, seven island-type coat racks and a number of additional wall hangers.

The hot water supply is provided by a self-contained and fully-automatic hot-water supply apparatus comprising two 150-gall. hot-water storage cylinders connected to a "Potterton" gas-fired boiler—"Rex" D Series, 2 Sections, which has an output of 83 galls. of water raised through 80 deg. F. per hour when burning at the full rate of 183 cub. ft. of gas per hour (450 C.V.). The two storage cylinders are heavily insulated with granulated cork retained in the space between the inner galvanized cylinders and the external sheet-steel jackets, and are cross-connected so that draw-off takes place evenly through both, and the advantages of stratification are not lost when heating up.

The hot water is stored in the cylinders at a temperature of 150 deg. F. and when drawn off is mixed with cold water in a Wynne's thermostatic blender to give a temperature at the sprays over the washing accommodation of approximately 115 deg. F. Cold-water storage of 300-galls. capacity is provided by two open-top cisterns mounted over the storage cylinders on extensions of the steelwork.

The sprays to both fountain and troughs are foot-operated to ensure the utmost economy in water and, of course, gas consumption—the latter being most important in this instance as almost the entire available supply is absorbed for production requirements. Gas-fired apparatus was chosen for the hot-water supply,

(*Continued on page* 486, *Col.* 1)

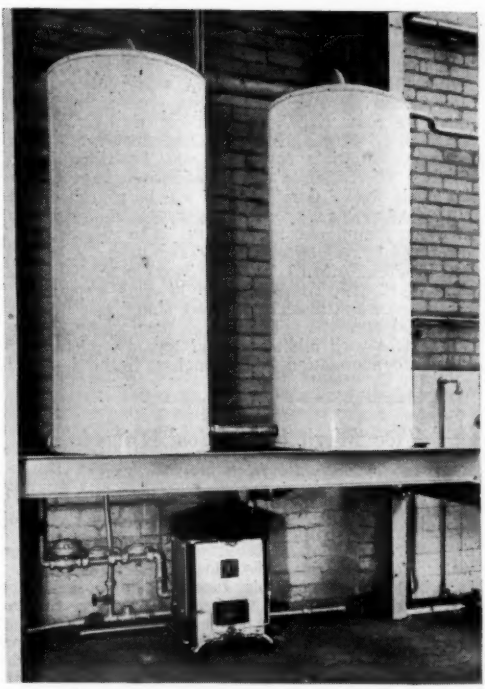


FIG. 1.—*Gas-fired Boiler and Hot-water Storage Installation incorporated in the New Foundry Ablution Block of Thomas de la Rue & Company, Limited.*

Review of B.S. 1400

It is understood that the British Standard Schedule 1400 "Copper-alloy Ingots and Castings" which was published in 1948 will be due for review next year. In order that consideration may be given to suggested amendments, readers are invited to inform The Association of Bronze & Brass Founders of any revision which they consider desirable. The following points have already been suggested:—(*a*) The altering of ingot specifications for gunmetal by increasing the zinc content 0.5 per cent. above that of the related casting specification to allow for melting loss; (*b*) the testing procedure and mechanical properties of the gunmetals used for valves to be reviewed because of the higher values given in equivalent American standards; (*c*) the detailing of "other elements"; (*d*) the inclusion of upper and lower limits for copper in standards which at present give copper "remainder"; and (*e*) the deletion of references to "cast-on" test-bars.

Relevant remarks should be addressed to the secretaries, Heathcote & Coleman, 25, Bennetts Hill. Birmingham, 2.

Comments and suggestions will be greatly appreciated in particular on the following points:—(1) Which alloys in B.S.1400 are favoured most for the economic production of sand castings, die castings, and chill-cast stick; (2) are there any alloys in B.S.1400 which could be omitted; (3) are any alloys in regular use which have been omitted from B.S.1400? Reasons should be quoted.

Work Study Training for the Midlands. As a culmination of the development of the teaching of Work Study (motion study, time study, job evaluation and incentives) over the past five years in the Department of Industrial Administration of the College of Technology, Birmingham, the Department announces a series of full-time courses in the Practice of Work Study. The full-time courses at Birmingham will each be of six weeks' duration, and will be restricted to ten students training for, or holding, responsibility for work study in manufacturing industry. The courses will be directed by Geoffrey P. Wade, B.Sc., A.M.I.E.E., M.I.Prod.E., A.M.I.I.A., and by Victor N. Picken, A.M.I.E.E., who combine some 30 years' experience in the practice and teaching of work study, in well-known industrial concerns. The college fee for the course is 50 guineas with additional and separate charges for hotel accommodation in Birmingham if this is desired.

Two More Foundries' Amenities

(*Continued from previous page*)

however, because it was the only plant which could be housed in the washroom itself—the only space available. In view of the limitation of gas supply, the size of boiler was kept to a minimum, and a large, hot-water storage capacity was incorporated; this storage is built up to temperature during the night and those periods during the day when the washroom facilities are not in use, thereby spreading the hourly boiler input.

The peak load is, to a certain extent, lightened, due to the fact that the leaving times of many of the foundry workers do not coincide, and thanks to the efficient insulation of the storage cylinders the boiler provides ample hot water for all washing requirements in addition to feeding low-level heating coils below all the coat racks.

The Iron and Steel Institute

For its annual special meeting this year, the Iron and Steel Institute went to Swansea, conforming to the policy of holding this function at home and abroad in alternate years. An innovation this year was that no papers were presented or discussed, all the interest being centred on the works visits. As these included all departments of the Steel Company of Wales—major studies in themselves—the programme was most adequately filled. The attendance of over 600 members and ladies was sufficient proof of the general interest, and notwithstanding the difficulty of hotel accommodation for such an assembly, a precisely-timed system of bus transport and a large number of private cars made attendance at the various functions quite simple.

The first visit was to the Trostre works, where all the departments of the cold-reduction plant and the tinplate mill are now in operation, and tinplate is being produced in West Wales for the first time by the electrolytic process. This visit opened with a luncheon which was held in the tinplate warehouse and was attended by about 1,200 guests, including Mr. Duncan Sandys, the Minister of Supply. Mr. E. H. Lever, chairman of the Company, who presided, said that it was only plants like Trostre which, in the long run, could maintain for South Wales its position in the world markets as a producer of tinplate. He also pointed out that that day marked the conclusion of the first stage in the development programme of the sheet and tinplate industry of South and West Wales. The very large company assembled thereafter inspected the works and particularly keen interest was shown by visitors from overseas.

For the next part of the meeting the members had hoped to visit the Margam and Abbey works of the same company, but a very unfortunate and untimely strike prevented the tour of these works being made. The other works visits, however, were very much enjoyed by the members, and one must commend the enterprise of the Iron and Steel Institute in making fresh arrangements at very short notice. Reflecting on the meeting as a whole, and apart from the unfortunate cancellation of the works visits, the excellent timing and arrangement of all the functions, the tremendous body of keen and informed interest, and the promise of a major place for South Wales in the steelmaking world were particularly noted.

Muffle Furnaces. Gradec Limited, 96, Hackney Road, London, E.2, have prepared a leaflet which describes and illustrates a new line of electric muffle furnaces which they have recently placed on the market.

With effect from November 1, all correspondence, with the exception of statements of account, for G.K.N. Group Research Laboratory should be addressed to Birmingham New Road, Lanesfield, near Wolverhampton.

Latest Foundry Statistics.—For the second month running, the September issue of the Bulletin of the British Iron & Steel Federation reports a decline in employment in iron foundries. The reduction has been from 153,665 in July, to 152,939 as at August 9, that is 726. However, there are still over 2,800 more employed than in 1951. Steel founders too had a recession for at 20,318 in August there were nearly 500 fewer than in July, but again employment was much higher than in 1951, when 19,053 were employed. The average weekly melt of metal for pouring into steel castings showed a good rise during August to 2,110 tons, which compares with 2,070 in July and 1,730 in August, 1951.

The Foundry Trades' Equipment and Supplies Association, Limited

At the Annual General Meeting of the Foundry Trades' Equipment and Supplies Association, held on October 22, 1952, the following report was given to members.

Membership. The number of Members of the Association on December 31, 1951, was fifty-five, eight new Members having been admitted during the year and there were two resignations.

Accounts. The accounts for the year ended December 31, 1951, showed an excess of income over expenditure of £65 5s. 2d., leaving a balance of £57 1s. 3d. to be carried forward.

Meetings of the Council. Meetings have taken place throughout the year and on these occasions many matters of specific interest to the industry have come forward for discussion.

Handbook. During the year copies of the British Foundry Plant and Supplies Handbook have been dispatched to foreign foundries and other interested concerns. The Handbook Committee, consisting of Mr. W. Rawlinson, Mr. V. C. Faulkner and Mr. C. Orton Foster, have proceeded with the compilation of data required for the up-to-date publication, which is now being prepared.

Exhibitions. Arrangements were made for a Foundry Trade section to occupy the annexe at Olympia in the Engineering, Marine and Welding Exhibition in August, 1951, and twenty-two Members of the Association exhibited in this particular section.

Factories Department. Representatives of the Association have continued to attend meetings of the Subcommittee on Conditions in Iron Foundries during the year and close liaison has been maintained. From Minutes of meetings, extracts of which have been circulated to all Members, it will be observed that amongst other matters, work has proceeded in regard to the question of mould driers and ladle driers and heating.

Ventilation Committee (Pedestal Grinders). This Committee, under the chairmanship of Mr. G. E. Lunt, formed to investigate problems in connection with dust hazards on pedestal grinders, have continued to meet and work has progressed in conjunction with the British Steel Founders' Association, who have provided a Dust Research Station at Sheffield. Three manufacturers of pedestal grinders have kindly loaned their machines for the purpose of having tests carried out and for testing modifications.

British Standards Institution. Mr. J. G. W. Lowe has continued to serve as the Association's representative on Technical Committee MEE/22—Foundry Equipment and Foundry Patterns and the revision of BS:467—Marking and Colouring of Foundry Patterns has been concluded. Work was commenced on the preparation of a new standard for foundry moulding boxes and Members concerned have been approached in regard to the possibility of setting up a committee to consider the standardization of moulding machines.

Government Departments. The Association has, from time to time, consulted government departments on matters affecting the interests of Members and the industry. There is much evidence of the increasing recognition of the Association as a medium and the proper authority for consultation and the dissemination of important information.

General. In reviewing the activities of the Association during the past year, the Council feel it can be justly claimed that it has been eventful and that significant and important matters have been dealt with. The Council have constantly in mind the desirability of using the Association as a means of keeping all its Members in touch, not only with each other, but with details of all matters of common and mutual interest. It cannot be too strongly emphasized that the Association is in existence for the promotion of the interests of Members and they are therefore urged to use its facilities on every possible occasion where it is felt that its full weight can be brought to bear on problems which might otherwise be dealt with comparatively less effectively. In concluding their report, the Council feel strongly that the efforts of those individuals serving as official representatives of the Association in one direction or another, who give much of their valuable time and energy in the cause of the industry generally and of the Members of the Association in particular, should be acknowledged with warm appreciation and grateful thanks.

The Report is signed by Mr. W. E. Aske, President; Peat, Marwick, Mitchell & Company, Secretaries.

File Improperly Used

By a majority of 8, a jury sitting with Lord Strachan at the Court of Session awarded £1,250 damages to Angus McPhee, a Glasgow moulder, who sued G. & J. Weir, Limited, Holm Foundry, Glasgow, for £3,500 damages in respect of injury to his left eye suffered on August 22, 1950, while employed with them. He contended that, while dissecting the segments of a pattern, he had to make use of a makeshift tool in the form of an old file, because defenders did not supply the appropriate appliance. As a result of striking the file with a hammer, a small fragment of metal from the file penetrated his left eye, resulting in almost total loss of the sight of the eye. The defenders, who denied liability, maintained that appropriate tools were available and that pursuer ought to have known that it was dangerous to use a hard steel file instead.

Hacksaw Blades to be Standardized

Mr. E. A. Tuxford, secretary of the British Hacksaw Makers' Association, announces that following an agreement between British, American and Canadian manufacturers, the sizes of hacksaw blades will be standardized from January next. The agreement also provides for the introduction of 4 teeth per in. as a standard tooth number. Thicknesses will be measured in decimals of an inch, and there will be one width only for each thickness, while lengths will be more simply and evenly graded. A comprehensive research programme has been carried out to ensure that the combinations of length, width and tooth numbers will meet all normal sawing requirements, and provide maximum efficiency and economy. On this basis, a new British Standard for hacksaw blades is being prepared. Prices will not be affected by the agreement.

Members of The Association of Bronze & Brass Founders have been invited through their secretaries (Heathcote and Coleman, 25 Bennetts Hill, Birmingham, 2) to participate in the dinner/dance and cabaret function organized by the British Bronze & Brass Ingot Manufacturers Association and to be held on November 8 at Grosvenor House, Park Lane, London, W.1. The A.B.B.F. president will attend and hopes that the Association will be well represented. The cost is £3 3s. 0d. each and application for tickets should be made to the secretaries.

United Kingdom Trade in September

The provisional value of United Kingdom exports in September was £186,200,000. There were 26 working days in September, compared with 25 in August, and although the September total was higher than the August figure (£180,800,000), the daily rate of export fell by 1 per cent. between the two months. The monthly average value of United Kingdom exports in the third quarter was £191,500,000, compared with £224,400,000 in the first half year, and the monthly average for January-September was £213,400,000, slightly below the average of £215,000,000 for 1951.

Imports into the United Kingdom in September were again lower at £238,400,000, bringing the average for the third quarter to £262,300,000. The value of imports (c.i.f.) during January-September was 8 per cent. below the average for 1951.

With re-exports at £8,500,000, the excess of imports (c.i.f.) over exports and re-exports (f.o.b.) was £43,700,000 in September and for the period January-September was £652,400,000, or a monthly average of £72,500,000.

The provisional total for United Kingdom exports to North America in September was £22,800,000, bringing the monthly average for the third quarter to £23,200,000—almost the same as the figure for the second quarter on a working day basis—compared with an average of £21,000,000 for the first half year. Exports to the United States in the third quarter were slightly below the average for the first six months, while exports to Canada increased by 28 per cent., an important part of this increase being due to the high value of exports to Canada in July.

European Coal and Steel Community Finances

It is reported that the question of finance for the administrative expenditure of the European Coal and Steel Community has been provisionally settled. The contribution to be made by each enterprise will be based on the value of its production, each producer paying 1 per cent. of the value of its coal or steel output.

According to preliminary estimates, the total value of the production of the community amounts to some 240,000,000,000 Belgian francs (approximately £1,700,000,000). A levy of 1 per cent. on this production would provide total receipts of the order of £17,000,000 per annum.

The proportion to be paid by the enterprises of the member countries is estimated approximately as follows:—West Germany 40 per cent., France 25 per cent., Belgium 16 per cent., the Saar 7 per cent., Italy 3.5 per cent., Luxembourg 3.1 per cent., and the Netherlands 3 per cent.

West Germany, with its preponderance of coal and steel production within the community, thus makes the largest contribution. The Germans have also proposed that the salaries offered to the officials of the community should be high enough to attract top-grade men with wide experience in coal and steel. The salaries so far suggested, which will be payable free of all Luxembourg taxation, are $15,000 a year for the president of the High Authority, $14,000 for the vice-president, and $12,000 for the other members of the High Authority. The salaries proposed for the higher administrative personnel range from $6,000 to $10,000 a year.

Records by Qualcast

For the year ended June 30 last the profit earned by Qualcast, Limited, Derby, before providing for taxation, was £634,748, compared with the previous year's £572,004, and represents 88.2 per cent. on the issued ordinary capital, after allowing for the preference dividend, or 38.1 per cent. on the real capital employed. "This increase in profit," says Mr. J. E. V. Jobson, the chairman, in his statement accompanying the accounts, "has been achieved entirely through increased output. The tonnage of castings produced in our foundries is an all-time record, as is our total turnover, including finished products, which has increased by 9.2 per cent. There is no question but that this is a very fine achievement, particularly when one realizes that it has been accomplished on a lower percentage of profit on turnover than that of the average of the five pre-war years. In fact, the average percentage of profit for the last five years is less than that of the five pre-war years."

Referring to taxation, Mr. Jobson comments:—"The country, I am convinced, is coming through, and brighter days are ahead if we keep our feet on the ground, but just as a farmer first of all sets aside out of his harvest his seed corn for next year, so industry must be allowed to set aside adequate reserves, to be able to improve the standard of living and safeguard all our jobs. It is wealth production we want—a greater volume of goods at steadily lowering prices. . . . Today we have a position in which the Government, through taxation, is a majority sleeping partner in industry, one who runs no risk of losing his capital, because he has none, but who relies upon his junior partner to provide all the plant and working capital necessary, all the organization, and take all the risks of the trade."

The chairman states that the £300,000 reorganization scheme at the Derby works is "now coming nicely into operation." The firm's order-books are in a very satisfactory condition. Costs, he believes, have now reached their peak and in some instances show a definite downward trend.

East African Markets

Mr. G. T. Dow-Smith, U.K. Trade Commissioner for East Africa, visited Sheffield on October 9 and 10, calling on Walker & Hall, Limited, Edgar Allen & Company, Limited, and Tinsley Wire Industries, Limited. In addition to works visits, he had private interviews with many other representatives of local exporting firms. Speaking of the poor quality, high price, and misleading descriptions of some British goods, he said these had been the cause of the loss to Germany of the major part of the cutlery trade with East Africa, a matter of hundreds of thousands of pounds annually. Emphasizing the importance of Kenya, Uganda, Tanganyika and Zanzibar to British manufacturers, he said that the population included 50,000 Europeans, in addition to 18 million natives and half a million Arabs and Asiatics. There was thus a good though limited market for quality products, as well as a great potential market for lower-priced goods. East Africa had as yet no secondary industries and imported practically all manufactures, yet long delays in delivery from British firms had allowed Continental manufacturers to compete by selling goods at higher prices, but giving quicker delivery.

AN ORDER has been received by Wm. Doxford & Sons, Limited, Sunderland, from Thomas & J. Harrison, Limited, Liverpool, for a motor cargoship of 6,100 gross tons.

Personal

MR. JOHN HUNTLEY, of Giffnock, Glasgow, has been appointed chairman of Sir William Arrol & Company, Limited, Glasgow, bridge builders and general engineers.

MR. P. F. GROVE has left John Miles & Partners (London), Limited, to take up an appointment with McLellan & Partners, consulting engineers, of London, S.W.1.

MR. C. W. KELSEY (chief purchasing officer, the London Electric Wire Company & Smiths, Limited), has been elected president of the Purchasing Officers' Association.

MR. ADAM DUNLOP has resigned from Rolls Royce, Limited, on his appointment as technical director of Shaw Processes, Limited, 3, Queen Street, Newcastle-upon-Tyne, 1.

MR. HAROLD R. NEWMAN, general manager of the Butterley Company, Limited, engineering works, Ripley, has been installed president of the Institute of Welding, East Midlands branch.

MR. FRANK C. BARFORD, manager at Newcastle-upon-Tyne of the British Thomson-Houston Company, Limited, for six years, is to take up a similar appointment at Manchester. He has been with the company for 30 years.

MR. WALTER HACKETT, Junr., joint managing director of Accles & Pollock, Limited, seamless steel tube manufacturers, of Oldbury, has left this country on a business trip to the United States and Canada. He expects to be away just over three weeks.

MR. R. H. JONES (South Western Agencies), 21, Castle Street, Cardiff, has been appointed by Walter Slingsby & Company, Limited, Keighley (Yorks), to act as representative for South Wales and south-west England for the sale of malleable-iron pipe fittings and unions.

SIR ROBERT GOULD, C.B., Chief Industrial Commissioner, has retired from established service in the Ministry of Labour and National Service, but is continuing as Chief Industrial Commissioner, in a temporary capacity, for a short period. He is to be succeeded by MR. H. G. GEE, C.M.G.

AT THE BEGINNING of this month MR. G. W. G. CANTER, manager of the marine and special contracts department of Metropolitan-Vickers Electrical Company, Limited, since 1945, moved into the company's London office in St. Paul's Churchyard. MR. J. NICHOLSON, who has been appointed assistant manager of the department, will be located at Trafford Park.

MR. E. BRUCE BALL, joint managing director of Glenfield & Kennedy, Limited, Kilmarnock, will represent the engineering industries on the Government-sponsored trade mission which will leave next month on a six-week tour of Venezuela, Colombia, Cuba, Mexico, and the Dominican Republic. The object of the mission is to examine the possibilities of increasing U.K. trade with these countries.

MR. LAWRENCE W. ROBSON has been appointed deputy chairman of Associated British Engineering, Limited, Loughborough (Leicester). MR. ALAN P. GOOD, who, as announced last week, has resigned on medical grounds from the managing directorship of the Brush Electrical Engineering Company, Limited, the parent company of the Brush Aboe group of companies, is retaining the chairmanship of Associated British Engineering.

MR. W. C. CHURCHWARD, area training officer of Stewarts and Lloyds, Limited, and secretary of the Staffordshire Iron and Steel Institute, is leaving on January 1 to take up a new appointment as education and training officer of the Roan Antelope Copper Mining Company, at Luyansha, near N'dola. Mr. Churchward will be responsible for the education and training side of one of the largest copper-mining concerns in the world, with a European staff of 1,500 and 11,000 African employees. He will leave Stewarts and Lloyds, with which he has been associated since 1936, at the end of this month.

MR. R. S. CRUMP, technical director and chief engineer of Henry Meadows, Limited, Diesel engine manufacturers, etc., of Wolverhampton, retires as chief engineer, but remains on the Board and continues his long association with the company as technical consultant. MR. J. E. ROBINSON, chief technical supervisor of Petters, Limited, joins the firm as chief engineer. The position of technical adviser has been taken over by MR. G. WEDGE, sales manager; MR. E. B. CHRISTIE is appointed contracts manager, while MR. A. F. BROWN, who recently joined the firm, is sales promotion manager.

MR. WILLIAM MURE has been elected chairman of the council of the Zinc Development Association. He is managing director of British Metal Corporation, Limited, London, E.C.2, and a director of Amalgamated Metal Corporation, Limited, London, E.C.2, James Bridge Copper Works, Limited, Walsall (Staffs), Wolverhampton Metal Company, Limited, and a number of other companies. Aged 54, Mr. Mure was educated at Wellington, and the Royal Military Academy, Woolwich, and in the first world war served in the Royal Field Artillery, and the Royal Horse Artillery. From 1940 to 1945 he was Joint Controller of Non-ferrous Metals.

MR. HERBERT FOSTER, chief die designer to Daniel Doncaster & Sons, Limited, Sheffield, was presented last week with the British Empire Medal by the Earl of Scarborough, acting on behalf of the Queen in his capacity as Lord Lieutenant of the West Riding. The award was made for Mr. Foster's design of a die which was stated to have saved hundreds of thousands of working hours and for his "wonderful training of apprentices." Another Sheffield craftsman, 67-year-old MR. CHARLES SKELTON, who received the B.E.M. from the Earl. He is a horizontal boring specialist at the Darnall works of the Davy & United Engineering Company, Limited.

Obituary

MR. JAMES EVANS, who died recently at the age of 88, was formerly chief ironworks' accountant of Pease & Partners, Limited, Darlington.

THE DEATH occurred on October 15 of MR. AMOS BARBER, of Bradford, at the age of 77. Mr. Barber devoted practically the whole of his life to model engineering.

MR. LAWRENCE GOLIGHTLY, chief draughtsman since 1946 of Robert Stephenson & Hawthorns, Limited, locomotive builders, of Darlington (Yorks), has died at the age of 57. He joined the company in 1911.

THE DEATH is announced of MR. ERNEST P. BARLOW at his home in Sheffield on October 16. He was 58. Mr. Barlow was a member of the Institute of British Foundrymen and was for many years, until his death, a well-known figure in the Foundry Supplies Department of Thos. W. Ward, Limited, in Yorkshire, the Sheffield area, and on the North-East Coast. He joined the firm at the age of 15.

News in Brief

THE ARMES MACHINE COMPANY, LIMITED, have opened a new industry at Tideswell, Derbyshire, for the installation, alteration, maintenance and repair of textile machinery.

ABOUT 400 ATTENDED the diamond jubilee celebration at Larbert recently organized by the General Iron Fitters' Association, when Mr. Edward Philip, Camelon, president of the executive council, presided.

THE LORD MAYOR and Lady Mayoress of Stoke-on-Trent joined with directors and more than 200 employees at a celebration dinner to mark the centenary of William Boulton, Limited, pottery engineers.

COLVILLES, LIMITED, are to construct a new merchant mill at Dalzell Steel Works, Motherwell, at a cost of £85,000. This mill is part of the Dalzell modernization scheme and will roll steel bars, rounds and angles.

A SUBSIDIARY COMPANY has been formed by H. J. Enthoven & Sons, Limited, lead smelters and refiners, of London, E.C.3, to market its solder and solder specialities. The new company will be named Enthoven Solders, Limited.

A RUTHLESS SEARCH for scrap was requested of managing directors by Mr. H. Boot, managing director of the Consett Iron Company, Limited, and chairman of the North-East Coast Scrap Drive Committee, in a report on the steel position submitted to the Northern Regional Board for Industry.

W. P. BUTTERFIELD, LIMITED, engineers and tank manufacturers, of Baildon, near Shipley, have made a start on a 15-year plan for the rebuilding of their works and offices on their present site in Otley Road, Baildon, incorporating extensions over the adjoining recreation ground which they recently acquired from Baildon Council.

THE OWNERS of the various systems for fixing insulating linings in buildings with metal components have formed the Metal Fixing Association, with offices at 32, Queen Anne Street, London, W.1. It includes in its objects the defining of minimum standards of materials and workmanship, and the first code of practice is expected to be published shortly.

AS A RESULT of a public inquiry held nearly three years ago, the Minister of Housing and Local Government has informed Kettering Rural District Council that 950 acres of land at Geddington and Newton Quarry may be mined for ironstone. As much as possible of the mined land will have to be restored so that it can again be used for agricultural purposes.

PATERSON HUGHES ENGINEERING COMPANY, LIMITED, announce that their Midlands Office has moved into larger premises at 3, Highfield Road, Edgbaston, Birmingham, 15. This has been due to considerable expansion of business and services in the area covered. The Midlands area manager is Mr. J. Ford, assisted by Mr. L. R. Kemp. (Telephone number EDGbaston 1639.)

CLYDE NAVIGATION TRUSTEES have agreed to modernize the electrical installation at Rothesay Dock at an estimated cost of £131,000. It is expected that this will save £2,000 per annum through increased efficiency. A scheme for the strengthening of the roof of the cable tunnel at the South Quay, King George V Dock, at an estimated cost of £3,500, has also been approved.

A NEW SERVICE for members of the Coal Utilisation Council's panel of authorized appliance distributors and for coal merchants will begin in November. The council has appointed two display experts, Mr. Alan T. Gordon and Mr. Norman Turner, who will be available to advise panel members and merchants on how to make the best possible use of their showrooms and windows.

A PIG OF LEAD weighing some 140 lb. and recently turned up by the plough at "The Owslow," a farm at Carsington, Derbyshire, is now being examined by experts, who consider that the lead was smelted round about the time of the Roman occupation of Britain. The pig bears various incised marks, which may enable the experts to trace its origin. The area in which the lead was found has been proved to have been, many years ago, the site of considerable lead mining operations.

THE DAVID BROWN COMPANIES have recently acquired the first-floor suite of 96, Piccadilly, London, W.1, as their new London headquarters. As from Monday, October 27, the present London office sales staff will be transferred from Bush House, London, W.C.2, to the above address (telephone number, GROsvenor 7747). For the time being the London office of David Brown Tractors, Limited, will remain at 49-50, Avenue Chambers, Vernon Place, Southampton Row, London, W.C.1, but this will be transferred about the end of the year.

THE DIRECTORS of Coltness Iron Company, Limited, are pleased to intimate that they have accepted an offer from G. & J. Weir, Limited, Cathcart, Glasgow, for the purchase of their foundries and certain ancillary departments at Newmains. It is understood that the purchasers intend to continue the foundries in operation. The successful conclusion of the negotiations is gratifying to the board of Coltness Iron Company with regard to the employment situation in Newmains, and the helpful efforts of the Scottish Council should also be mentioned.

DURING THE FIRST EIGHT MONTHS of this year British Railways carried approximately 10 million tons of iron ore, an increase of more than 900,000 tons compared with the same period in 1951. In 1953 iron ore carryings by rail are expected to amount to over 17 million tons, an increase of 2,800,000 tons above those in 1951. To provide for this increase British Railways are to build in their own workshops at Shildon, Co. Durham, 1,240 more ironstone tippler wagons of 27 tons capacity to supplement the present stock of 2,300 wagons of this type and the existing fleet of hopper wagons.

ARRANGEMENTS have been made by the Ministry of Education to award 120 Technical State Scholarships in 1952 to students from technical colleges and other establishments for further education. These scholarships will be offered to students to enable them to pursue full-time degree courses or courses of equivalent standard at the universities. Full particulars of the conditions of entry and method of application for these scholarships are given in an explanatory leaflet, Form 1.U.T., which will shortly be distributed to local education authorities, and principals of establishments for further education.

DETAILS of an accident which occurred in December, 1949, at the foundry of the Humber Company, Limited, Coventry, were heard before Mr. Justice Lynskey at Birmingham Assizes on October 17, when Charles Campbell, aged 52, a millwright, was awarded £2,227. For the plaintiff, it was stated that he heard a knocking noise in the machine operating conveyors in the foundry, and while investigating the cause, he caught his arm, which was badly mangled, in the machinery from which he had removed the guard. The Judge held that the defendants were guilty of not providing a safe place of work, but the plaintiff had contributed to the accident by taking an undue risk. Because of his contributory negligence he was awarded only two-thirds of the sum that would otherwise have been awarded to him.

CUT YOUR KINDLING COSTS BY 2/RDS 3

★ 6ft. flame takes only 10 minutes to kindle cupolas

'Handyman'

PORTABLE PRESSURE BURNER

Already used by leading foundries throughout the country, the 'Handyman' will save up to £50 per annum per medium size cupola on wood alone.

- Lights a cupola on a shillingsworth of fuel.
- Skin dries moulds and cores.
- Dries ladles, shanks and cupola spouts.
- Can also be used for spray-painting equipment and works with air conditioner attachment.
- Adjustable, but maximum working pressure 100lbs. per sq. in.
- Size 54in. × 20in. × 40in. shipping weight 200lbs.
- Displacement 6 cu. ft. per minute.
- Preheats metal receivers to red heat.

BURTONWOOD ENGINEERING CO., LTD.,
AIR UNITS DIVISION · BRYN · NR. WIGAN · LANCS.
Phone: WIGAN 3814 (3 lines)
Grams: Air Units, Bryn, Wigan

Pig-iron and Steel Production

Statistical Summary of August Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarizes activities during the previous six months; Table II gives production of steel ingots and castings in August; Table III, deliveries of finished steel; Table IV gives the production of pig-iron and ferro-alloys in August, and number of furnaces in blast. All figures in thousands of tons.

TABLE I.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1950	249	174	197	185	197	9	313	241	997
1951	284	170	206	186	175	8	301	243	589
1952—March	306	184	221	202	181	23	320	253	551
April[1]	305	184	224	201	171	29	305	248	576
May	326	183	231	201	174	45	312	264	586
June	310	186	231	200	170	43	313	258	663
July[1]	306	194	233	202	150	38	274	225	768
August	300	194	232	202	151	31	280	—	823

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in August*, 1952.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.8	10.6 (basic)	1.6	0.2	15.4	0.8	16.2
Lancs. (excl. N.W. Coast), Denbigh, Flints, and Cheshire	1.5	11.7	—	1.5	0.4	14.1	1.0	15.1
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	25.4	—	—	0.1	25.4	0.1	25.5
North-East Coast	1.1	53.2	—	0.9	0.4	54.1	1.5	55.6
Scotland	4.1	37.6	—	1.4	0.7	41.9	1.9	43.8
Staffs., Shrops., Worcs. and Warwicks	—	14.9	—	0.7	0.6	14.9	1.3	16.2
S. Wales and Monmouthshire	5.0	51.4	5.7 (basic)	1.0	0.1	62.7	0.5	63.2
Sheffield (incl. small quantity in Manchester) ..	6.4	24.0	—	6.7	0.4	35.8	1.7	37.5
North-West Coast	0.4	0.9	4.6 (acid)	0.4	0.1	6.3	0.1	6.4
Total	18.5	222.9	20.9	14.2	3.0	270.6	8.9	279.5
July, 1952[1]	20.0	215.3	20.8	14.6	3.1	265.3	8.5	273.8
August, 1951[1]	18.7	213.1	19.4	12.5	2.7	258.7	7.7	266.4

TABLE III.—*Weekly Average Deliveries of Finished Steel.*

Product.	1950.	1951.	1951.	1952.	
			July.	June.	July.
Non-alloy steel :					
Ingots, blooms, billets and slabs[4]	3.6	4.0	3.1	4.3	3.8
Heavy rails, sleepers, etc.	11.3	10.1	10.7	12.2	10.2
Plates ⅛ in. thick and over ..	40.0	41.0	31.2	41.2	35.7
Other heavy prod. ..	40.2	39.9	35.2	41.9	29.7
Light rolled sections and bars ..	47.6	47.1	42.5	48.4	40.5
Hot-rolled strip ..	19.4	19.5	20.1	19.1	16.0
Wire rods	16.3	16.1	12.6	16.2	11.7
Cold-rolled strip ..	5.5	6.0	6.3	6.3	5.6
Bright steel bars ..	6.3	6.6	6.7	6.2	5.8
Sheets, coated and uncoated ..	30.5	33.5	35.3	38.6	36.5
Tin, terne and blackplate ..	14.3	13.9	13.3	16.0	16.3
Tubes, pipes and fittings	20.0	22.0	22.9	24.4	20.9
Mild wire	12.5	11.9	10.9	13.3	10.3
Hard wire ..	3.5	3.7	3.2	3.6	2.9
Tyres, wheels and axles	3.5	3.7	4.3	3.3	3.5
Steel forgings (excl. drop forgings) ..	2.2	2.3	2.2	3.1	2.4
Steel castings ..	3.5	3.8	4.0	4.4	4.2
Tool and magnet steel	[7]	[7]	[7]	0.5	0.5
Total	280.2	285.1	264.5	303.0	256.5
Alloy steel	10.6	12.3	12.1	14.8	14.3
Total deliveries from U.K. prod.[5] ..	290.8	297.4	276.6	317.8	270.8
Add : Imported finished steel ..	3.8	4.9	4.2	14.5	15.6
	294.6	302.3	280.8	332.3	286.4
Deduct : Intra-industry conversion[6] ..	55.6	61.5	54.8	76.1	63.2
Total net deliveries	241.0	242.8	228.0	258.2	225.1[8]

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys in August*, 1952.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts, Northants and Essex	26	—	16.2	23.4	1.2	—	40.8
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	6	—	7.6	—	—	0.7	8.3
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	14	—	27.7	—	—	—	27.7
North-East Coast	25	7.4	40.3	0.1	—	1.6	49.4
Scotland	9	0.8	12.4	3.3	—	—	16.5
Staffs., Shrops., Worcs., and Warwick ..	8	—	7.9	1.5	—	—	9.4
S. Wales and Monmouthshire	9	2.7	29.8	—	—	—	32.5
North-West Coast	8	15.9	—	0.1	—	1.3	17.3
Total ..	105	26.8	141.9	28.4	1.2	3.6	201.9
July, 1952[1] ..	103	27.0	139.0	30.2	1.3	4.1	201.6
August, 1951[1] ..	100	23.2	125.4	27.2	1.4	3.7	180.9

[1] Five weeks.

[2] Weekly average of calendar months.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] *i.e.*, Material for conversion into other products also listed in this table.

[7] Included with Alloy Steel.

F.&M. SILICOMANGANESE★ BRIQUETTES

F. & M. SILICOMANGANESE BRIQUETTES

have for many years proved to be the most efficient form of adding manganese to cupola charges in the production of Cast Iron. Almost invariably the melting of charges, composed of pig iron with predominant proportions of scrap iron, yields a cast iron deficient in manganese. Some 20 to 25 per cent. of the manganese present in the pig iron and scrap is lost on melting and when the usual low manganese content of the scrap iron is taken into account, it is obvious that the resulting cast iron will very frequently have such a low manganese content that defects in the castings, associated with a deficiency of this element, will become apparent. As a general rule, iron castings should contain not less than 0.4 per cent. of manganese and often a manganese content varying from 0.6 to 0.8 per cent. or higher is most desirable.

When steel scrap forms part of the charge, manganese in some form must always be added and ***F. & M. Silicomanganese Briquettes*** are most suitable for this purpose.

The high grade silicomanganese alloy used in our Briquettes of this type contains only 16 per cent. Silicon (this is frequently a matter of importance when charges containing steel scrap are melted)—there is no appreciable increase in the percentage of Silicon in the resultant cast iron—*but* the presence of Silicon *protects the manganese during its actual solution*, and the only manganese in the Briquettes which is consumed during the melting process is that used up in deoxidizing and refining the molten iron.

The alloy likewise contains only a comparatively small amount of carbon. In this respect it differs greatly in its action from ordinary ferro-manganese and high manganese pig irons in which the whole of the manganese is present in the combined state in the form of carbides. In cupola melting, particularly when the rate of melting is rapid, the time necessary for the dissociation of the carbides is insufficient, and most of the manganese added is frequently ineffective, both as a deoxidiser and in its action of converting any sulphide of iron into the comparatively innocuous sulphide of manganese.

The use of a silicomanganese alloy ***with a limited carbon content*** ensures the presence of FREE manganese which can ***immediately enter into reaction with the molten iron.*** The favourable characteristics of **F. & M. Silicomanganese Briquettes** may therefore be summarised thus: *Manganese* ***in the presence of Silicon*** *resulting in a higher residual content of manganese in the metal; the action of the manganese being so much more rapid due to the low carbon content of the alloy, and finally, the alloy as a whole being protected by the binder of the briquette during its progress through the oxidizing zone.*

Technical advice for any special working conditions gladly given on request

DIRECT FROM MANUFACTURER TO YOUR FOUNDRY

F. & M. SUPPLIES LTD

4, BROAD STREET PLACE, LONDON, E.C.2

Telephone: LONDON WALL 7222 (5 lines)

FOUNDRY & METALLURGICAL F.&M.S.L.

★ *We shall discuss our other Briquettes*

FERRO MANGANESE, FERRO CHROMIUM AND FERRO SILICON

in later advertisements

Raw Material Markets

Iron and Steel

Pig-iron production is at a high level and, with adequate supplies of ore and improved coke deliveries, it is anticipated that output will be maintained at existing furnaces. Additional plant is coming into operation shortly, so that an increase on present production figures seems assured. The requirements of basic-steel making pig-iron for the steel industry are very heavy, steelmakers being largely dependent on pig-iron supplies as the quantity of scrap is still very far short of requirements. More melting furnaces are now working than for some time past, but many are still idle for want of raw materials.

Pig-iron supplies for the foundries are easier than they were, this being due to a shrinkage in the call for castings, as well as reduced allocations by the authorities, the latter, in some instances, being smaller than the foundries contemplated. Output of their grades of iron, however, shows little surplus after current needs are satisfied; in fact, some grades are still in short supply. The demand for high-phosphorus pig-iron has declined with the reduced requirements of some of the light and textile foundries, but lower outputs necessitated by re-lining and repairs mean that many foundries are still short of this grade. The engineering and speciality foundries, whose needs are not now so great, are generally able to obtain sufficient pig-iron for their immediate requirements. The improved outputs of hematite have been of assistance, but, with the heavy demand for this grade from the steelworks, supplies are none too plentiful. The low- and medium-phosphorus grades are about sufficient for current needs.

The recent improvement in supplies of foundry coke is maintained and most consumers appear to have adequate tonnages on hand for current needs, but only moderate progress is being made with the building up of stocks.

The demand from home sources for the products of the re-rollers has shown some falling-off recently, and their export business for small bars and sections is practically non-existent. Improved deliveries of semi-manufactured steel have resulted in outputs being on a much better scale. Substantial tonnages of steel semis have been received from abroad, but some re-rollers report a slackening off in deliveries and this is again causing difficulties, increased pressure on home steelworks being the result. The allocations for the current period from home suppliers show no increase, although it is hoped that the record outputs of steel will ultimately result in the re-rollers receiving a larger share.

The sheet re-rollers are heavily employed on home and export orders. All grades of sheet are in heavy request, especially galvanized sheets.

Non-ferrous Metals

The weekend news that no solution had been found to the wages dispute in the Copper Belt and that a strike had been called to start last Monday morning came at the end of a week when dull conditions obtained on the markets. Lead, for example, was marked down by £5 5s. to £5 7s. 6d. per ton, and the metal did not look any too steady when it closed last Friday afternoon at £87 7s. 6d., sellers, for October shipment. The further fall of 1 cent in the American price to 14 cents affected sentiment adversely on the London market and it would be wrong to suppose that 14 cents is necessarily the bottom of the fall in the United States. Consumers here are still acting cautiously and, knowing that there is no scarcity of prompt lead, are sticking to a policy of short cover. One of these days there will doubtless be a change in sentiment, and when that time comes everyone will want to buy at the same time, resulting in a scramble. In the meanwhile it looks as if lead were moving towards this country in fair quantities and it may be doubted whether the Government will be called upon to dispose of any very large tonnage of the lead which was held in stock when the market opened on October 1. With the decline in the U.S. price to 14 cents, sales to that market are no longer so attractive.

Official quotations of refined pig-lead, October and January positions:—

Thursday, £88 5s. to £88 10s.; Friday, £87 to £87 5s.; Monday, £86 to £86 5s.; Tuesday, £85 10s. to £85 15s.; Wednesday, £80 to £80 5s.

The recent strength in the tin market gave place to a wave of weakness which brought the tin quotation down with a run. Demand for tin does not appear to be very brisk at the moment and it is not easy to explain the sudden uprush in the quotation that was seen earlier this month. There may, of course, have been some fears of interference with shipments of Bolivian concentrates to the U.K., for it has yet to be seen what the effect of nationalization on the tin-mining industry is going to be. Any hold-up in the flow of metal to our tin smelting industry would, of course, be a serious matter, but it must be borne in mind that Bolivia is vitally interested in maintaining her exports of tin to the U.S.A. and to the U.K.

Official tin prices were:—

Cash—Thursday, £966 to £967; Friday, £956 to £957; Monday, £953 to £954; Tuesday, £954 to £954 10s.; Wednesday, £954 to £955.

Three Months—Thursday, £949 to £950; Friday, £944 10s. to £945 10s.; Monday, £941 to £942; Tuesday, £943 to £943 10s.; Wednesday, £942 10s. to £943.

Increase in Virgin Aluminium Price

The Ministry of Materials announced on Monday that, as from that day, the price of virgin aluminium in ingot form was increased from £157 to £166 per long ton, delivered into consumers' works, for metal of a purity of 99 per cent. to 99.5 per cent. inclusive. There is no change in the premiums which came into effect on July 1 for metal of higher purity and for metal in notch bar form. The Ministry expects to be able to keep the price at this level at least until April, 1953.

The increased price is due to the higher cost of metal, which arises partly from the appreciation of the Canadian dollar.

Dinner

FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION

Last Tuesday the President of the Foundry Trades' Equipment and Supplies Association, Limited, Mr. W. Aske, entertained the Council at a dinner party held in the Pall Mall Room of the Royal Automobile Club to celebrate the Silver Jubilee of its inauguration. The guests were: Mr. V. C. Faulkner, Mr. A. C. Turner, and Mr. D. H. Wood (founders); Mr. Orton Foster, Mr. G. C. Lunt; Mr. D. Cherry Paterson; Mr. W. Rawlinson; Mr. Frank Webster, and Mr. R. W. Stot (secretary).

The Best Sand Binding Resins are . . .

FERGUSON'S

NESTOR BRAND

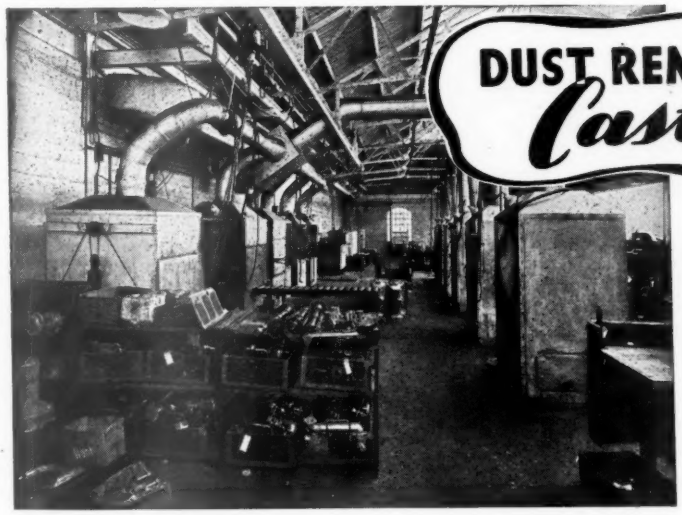
300 mesh powdered phenolic	Z.443
Liquid urea resin	V.37
Liquid cresylic resin ...	Z.477
Liquid phenolic resin ...	Z.212

All in Large scale production

James Ferguson & Sons Ltd.

LEA PARK WORKS · PRINCE GEORGE'S ROAD
MERTON ABBEY · S.W.19

Tel.: MITCHAM 2283 (5 lines)
'Grams: NESTORIUS, SOUPHONE, LONDON



DUST REMOVAL FROM *Castings*

TRADE SIROCCO MARK

Dust Removal Plant will solve this problem for you efficiently and economically.

Fully illustrated descriptive literature available on request.

DAVIDSON & CO. LIMITED,
Sirocco Engineering Works,
BELFAST, and at London, Manchester, Leeds, Glasgow, Birmingham, Newcastle, Cardiff.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

October 22, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £16 8s., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £15 19s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 14s. 6d.; South Zone, £17 17s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £18 14s. 6d.; South Zone, £18 17s.

Cold Blast.—South Staffs, £18 2s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £16 2s; Scotland (Scotch iron), £16 8s. 6d.; Sheffield, £17 3s.; Birmingham, £17 9s. 6d.; Wales (Welsh iron), £16 8s. 6d.

Basic Pig-iron.—£13 19s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 22s. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204; ditto, copper-free, £212.

Ferro-tungsten.—80/85 per cent., 28s. 7d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 31s. 7d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr; max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 6s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £49 0s. 8d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £41 12s. 6d.; galvanized corrugated sheets, 24 g., £53 3s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 7s. 9d.; nickel-chrome-molybdenum, £79 2s. 6d.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £285; high-grade fire-refined, £284 10s.; fire-refined of not less than 99.7 per cent., £284; ditto, 99.2 per cent., £283 10s.; black hot-rolled wire rods, £294 12s. 6d.

Tin.—Cash, £954 to £955; three months, £942 10s. to £943; settlement, £955.

Zinc.—G.O.B. (foreign) (duty paid), £118; ditto (domestic), £118; "Prime Western," £118; electrolytic, £122; not less than 99.99 per cent., £124.

Lead.—Refined pig-lead: October, £80 to £80 5s.; January, £80 to £80 5s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £138 15s.; rolled zinc (boiler plates), all English destinations, £136 15s.; zinc oxide (Red Seal), d/d buyers' premises, £142.

Other Metals.—Aluminium, ingots, £166; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £64 10s. to £64 15s.; nickel, £454.

Brass.—Solid-drawn tubes, 27d. per lb.; rods, drawn, 37d.; sheets to 10 w.g., 31⅝d.; wire, 32⅞d.; rolled metal, 29⅞d.

Copper Tubes, etc.—Solid-drawn tubes, 32⅜d. per lb.; wire, 317s. 9d. per cwt. basis; 20 s.w.g., 346s. 3d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £200 to £218; BS. 1400—LG3—1 (86/7/5/2), £218 to £238; BS. 1400—G1—1 (88/10/2), £345 to £375; Admiralty GM (88/10/2), virgin quality, £352 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £355 to £385; L.P.Bl, £250 to £275 per ton.

Phosphor Bronze.—Strip, 44d. per lb.; sheets to 10 w.g., 46½d.; wire, 49½d.; rods, 44½d.; tubes, 42½d.; chill cast bars: solids 4s. 4d., cored 4s. 5d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9½d. per lb. (7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3½d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 3½d. to 4s. 4½d.; to 25 in. wide × .056, 3s. 5½d. to 4s. 6½d. Spoon and fork metal, unsheared, 3s. 0½d. to 4s. 1½d. Wire, 10g., in coils, 3s. 9½d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 8½d.; 15%, 4s. 1½d.; 18%, 4s. 6½d. All prices are net.